PC-AMTOR

PCI-3000
MULTI-MODE
HF DATA MODEM

REFERENCE MANUAL

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QUALITY COMMUNICATIONS EQUIPMENT

PC-AMTOR

PCI-3000

MULTI-MODE HF DATA MODEM

for the IBM* Personal Computer

REFERENCE MANUAL

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PC-AMTOR REFERENCE MANUAL

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CHAPTER 1
INTRODUCTION

PC-AMTOR is supplied with two manuals - the OPERATOR'S GUIDE and the REFERENCE MANUAL (this book). Detailed operation instructions for each Code and Mode are described in detail in the OPERATOR'S GUIDE. This REFERENCE MANUAL will provide detailed descriptions for installation, special operations, Host Mode, and technical details of the HAL PC-AMTOR, PCI-3000, HF Modem for IBM*-Compatible Personal Computers (PC). PC-AMTOR software is designed to be very "user-friendly" and much of its operation is obvious and self explanatory. However, a careful reading of this manual is highly recommended so that you gain full benefit of all of the many features of the PC-AMTOR.

This HAL product has two names - "PC-AMTOR" and "PCI-3000". The manuals will use "PC-AMTOR" when referring to the system - circuit board hardware and HAL software. "PCI-3000" will refer specifically to hardware details.

A special "Let's Print Some Signals" section is included in Chapter 2 for those of us who are impatient. A close following of these simple instructions should make your PC-AMTOR work in short order. Once you get a "taste" of just how well your PC-AMTOR performs, we know you will then want to continue reading both manuals.

Chapter 2 includes the "Let's Print Some Signals" section plus detailed instructions for installation of the PCI-3000 circuit board in your PC and how to make connections to your transmitter and receiver system.

NOTE: Chapter 2 is very important - BE SURE TO READ IT!

A "minimum reading assignment" for all PC-AMTOR owners is Chapters 1 and 2 of this REFERENCE MANUAL and all of the OPERATOR's GUIDE.

Additional operation details are given in Chapter 3, including how to use disk storage and the on-line editor. Chapter 3 is supplemental to the OPERATOR'S GUIDE and does not duplicate or replace it.

Chapter 4 deals entirely with using the "Host Port" of the PCI-3000 circuit board. If you do not use APLink or a PC-based mailbox program, you may prefer to defer studying this Chapter until you add these features. Using the HAL-supplied PC software does not require use of the "Host Port".

Chapter 5 contains a complete Technical Description of the hardware used on the PCI-3000 circuit board. This Chapter may be read at your option, but the "engineers" among us will find the details interesting.

Chapter 6 explains how to make all alignment adjustments on the PCI-3000 circuit board. You may never have to read this Chapter - at least we hope so! However, the full details are included -- "just in case".

Chapter 7 lists all technical specifications of the PCI-3000. It is interesting reading, particularly if you want to compare notes with hams who have not yet purchased their own PC-AMTOR system.

Be sure to read the Limited Warranty. This is the form our lawyers tell us we have to include. What it means is that you get the standard HAL Warranty - the same one we have used for years. HAL stands behind its products. If you have a problem - LET US KNOW!

Finally, this manual includes a complete index. The index covers both manuals. Can't recall where you read a detail? --- TRY THE INDEX!

1.1 Unpacking and Inspection

Your PC-AMTOR system includes the following materials:

1 - 934-03000 PCI-3000 Circuit Board
1 - 870-03000 PC-AMTOR REFERENCE MANUAL
1 - 870-03001 PC-AMTOR OPERATOR'S GUIDE
1 - 870-03002 PC-AMTOR QUICK-LOOK INSTRUCTION CARD
1 - 865-03000 PC-AMTOR Software Diskette
1 - 333-20250 DB-25P (male pins) Cable Connector
1 - 333-51228 DB-25 Connector Shell

NOTE: The PCI-3000 circuit board is contained in a conductive-plastic protector bag. Do not remove the PCI-3000 circuit board from this protective bag until you are ready to install the board in your computer. When you do, remove the circuit board from the bag, be sure to follow the instructions in Chapter 2.

When opening your PC-AMTOR shipping carton, carefully inspect it for any evidence of shipping damage. Any damage should be immediately reported to your shipping carrier. Be sure to save any damaged packing materials as the carrier will have to inspect those if you have a claim. Note that a damage claim must be filed with the shipping carrier - NOT HAL Communications. HAL will of course be glad to assist in such cases, but it is only the shipping carrier who can pay damage claims.

Check to be sure that all of the materials listed above are contained in your PC-AMTOR package. If you find any materials missing, please contact your dealer or HAL Communications as soon as possible.

1.2 PC-AMTOR Accessories

The PC-AMTOR is a complete HF data communications package and will operate with just the materials supplied (plus your personal computer, transceiver, and antenna, of course). However, certain accessories will enhance the operation and use of your PC-AMTOR. These accessories are:

SPT-2 SPECTRA-TUNE^{tm} PC-AMTOR Tuning Indicator:

The SPT-2 provides a frequency spectral display of the audio output of your receiver. Tuning AMTOR, RTTY, or CW signals becomes very easy when using the SPT-2. The SPT-2 also includes a 6 foot cable for connection to the PCI-3000 I/O connector. The rear panel of the SPT-2 has eight RCA-type phono connectors to simplify radio connections. The SPT-2 also includes a separate "Host Port" "DCE-type" RS-232 connector (DB25S). Chapter 2 provides installation instructions for PC-AMTOR using the SPT-2.

FIL-1 Receive Filter Accessory:

The FIL-1 is a plug-in filter that may be installed inside the SPT-2. It provides additional receive selectivity for AMTOR/RTTY reception. The filter center frequency is 2210 Hz (1360 Hz for export) and has a bandwidth of approximately 500 Hz. This filter may greatly improve reception, especially if your receiver does not have a narrow IF filter.

DS-3200 Radio Data Terminal:

The HAL DS-3200 Radio Data Terminal makes an excellent "PC base" for use with PC-AMTOR. The DS-3200 is completely "IBM-compatible", is "radio-friendly" (very low RFI), and is available in either a two-floppy disk or hard disk version. Keyboard, CRT, and MS-DOS are included. Both 120 VAC, 60 Hz and 220VAC, 50 Hz models are available.

Other Tuning Indicators:

The HAL SPT-1 and PCI-EXT accessories for the PCI-2000 may also be used directly with PC-AMTOR and the PCI-3000. The PCI-EXT cable and signal break-out is 100% compatible with the PCI-3000. However, automatic scale switching between CW and AMTOR/RTTY is not provided nor are the CW and AMTOR/RTTY indicators or FIL-1 accessory available for the SPT-1.

The PCI-3000 rear panel connector also includes AMTOR/RTTY Mark and Space filter output signals that may be connected to an external X-Y oscilloscope. The Kenwood SM-220 Monitor Scope is a particularly useful accessory. However, the tuning scope display is <u>only</u> useful for AMTOR and RTTY; it will not show CW signal tuning as does the SPT-2 SPECTRA-TUNE.

Additional Software:

The PCI-3000 includes a special "Host Port" which allows use of non-HAL software to control the PCI-3000 hardware. Such programs include "APLink" and various "mailbox" ("BBS") programs. Use of the "Host Port" is discussed in detail in Chapter 4 of this manual. APLink and mail-box programs are available from other sources (not HAL).

CHAPTER 2
INSTALLATION

This Chapter discusses all of the steps necessary to install the PCI-3000 circuit board in your personal computer (PC) and to connect the PC-AMTOR to your radio station equipment. Immediately after installation, you will find "Let's Receive Some Signals", Section 2.2. Follow the installation instructions and we will soon have you receiving signals. Once receive works, we will go back and finish installation (hook-up the transmitter and other gadgets).

2.1 Installation

Everyone wants to see his or her new "gadget" work - and as soon as possible. Follow these instructions *exactly* and you will soon be "up and running".

> *NOTE: You can do the following installation without the SPT-2 SPECTRA-TUNE^{tm} accessory and the instructions note how to do it. However, life is a whole lot simpler if you have the SPT-2!*

2.1.1 Installing the PCI-3000 Circuit Board.

Before installing the PCI-3000, first be sure that your PC works! If it is a new PC, spend some time with it and learn how to use DOS functions - load programs, format and copy disks, and all the other "routine" PC type operations. If you have never used a PC, get a friend who has PC experience to help. Most computer stores also offer low-cost courses in how to run your PC. Good familiarity with your PC is essential to proper operation of PC-AMTOR.

Next, turn off all power to your PC and remove the top cover. The placement and number of PC cabinet screws varies from model-to-model, but the retaining screws are usually on the rear panel - about 5 of them.

> *NOTE: BE SURE TO SAVE THE SCREWS!*

Once you have the PC cabinet open, install the PCI-3000:

1. Locate an empty accessory "slot" in your PC and remove the blank rear panel for that slot (save the screw!). The PCI-3000 requires a full-length accessory slot.

2. Remove the PCI-3000 circuit board from the conductive bag and plug it into the empty slot in your PC. It should NOT be necessary to adjust any jumpers or the circuit board DIP switch at this time.

3. Fasten the PCI-3000 rear panel using the PC rear panel screw you saved in step 1.

4. If you have purchased the SPT-2 accessory (or have the SPT-1 and PCI-EXT), this is a good time to connect it to the PCI-3000.

5. Put the cover back on your PC. Be sure to screw the cabinet together to minimize RFI!

STATIC ELECTRICITY NOTE:

The PCI-3000 circuit board is not extremely sensitive to static discharge. With careful handling, static should not be a problem. However, if your environment is very dry (very low relative humidity), it may be wise to attach a clip-lead ground between the PCI-3000 rear panel and the PC cabinet while installing the board. Other precautions such as not wearing wool clothing while installing the board are also advisable.

2.1.2 Load PC-AMTOR software.

After installing the PCI-3000 circuit board and replacing the PC cover, install a bootable diskette in your PC (unless you have a hard disk). Now, turn the PC power switch ON. The PC should go ahead and "boot" just like it did before you installed the PCI-3000. If it does NOT, STOP RIGHT HERE AND CHECK YOUR INSTALLATION. Chapter 6 discusses some of the problems that might cause a failure at this point.

Assuming that your PC did boot correctly, it's time to try the HAL software. The HAL program, called "PCA.EXE" is contained on a standard 360K floppy diskette. The program is NOT copy protected and you may freely copy it to another diskette or onto your hard disk. The HAL disk does NOT contain system files required to "boot" the computer. We highly recommend that you copy the HAL diskette and then use the copy. Store the original diskette in a safe, dry, and non-magnetic location.

Your HAL diskette includes a special INSTALL program that will lead you through the whole disk copy and installation procedure. INSTALL may be used with either a dual-floppy diskette computer or one containing a hard disk. If you do not have a hard disk, be sure to have a new and blank diskette available.

No "bargain" diskettes, please - PC-AMTOR is worth a good disk!.

In the following instructions, type the commands that are underlined. The [Enter] notation means type the key labeled "Enter".

To INSTALL, PC-AMTOR:

1. Boot your PC.
   In a dual-floppy PC, put a system diskette in drive A: and turn the power ON.
   In a hard disk PC, just turn the power ON.

2. Put the HAL diskette in drive A: and type

   A: [Enter]

3. At the A:> prompt type:

   A:>INSTALL [Enter]

4. Follow the instructions!

If you have a dual floppy PC, you will be asked to put a new diskette in drive B: and PC-AMTOR files will be copied onto this diskette. If you have a hard disk system, a new sub-directory will be created named "PCA" and all PC-AMTOR files will be loaded into this directory.

5. When installation is complete, you will be directed to remove the HAL diskette from disk A: and either place the new diskette in drive A: (dual-floppy PC) or change to the C:\PCA sub-directory (hard disk).

6. Installation is done! Run PC-AMTOR by typing:

A:>PCA [Enter] (dual-floppy PC)
or
C:\PCA>PCA [Enter] (hard disk PC)

You should now see the opening screens of PC-AMTOR. Read the on-screen directions and try a few mode changes.

HINT: The [F1] key is "magic". It allows changing of any of the parameters. [Alt]-H gives you "HELP" information at any time.)

2.1.3 Connection to the Receiver:

For this "quick look" test, we will ONLY be concerned with reception. Connecting and using the transmitter comes later!

The receiver audio output is connected to either the SPT-2 "AUDIO IN" phono jack or to pins 1 (audio) and 25 (ground) of the PCI-3000 rear panel connector. It is much simpler to use the SPT-2 accessory!

Receiver audio output may be obtained from many places. While a 600 ohm constant-level audio output is certainly desirable, it is by no means necessary. The PCI-3000 contains special limiter and AGC circuits that are very forgiving of receiver audio output connections. For now, choose the simplest audio output you can find - the "EXT SPKR" or "PHONE PATCH OUTPUT" connectors are usually the simplest. If possible, use a receiver audio connection that does not defeat the receiver's speaker - at least for now.

If you do not have the SPT-2, be very careful when making connections to the 25 pin PCI-3000 I/O connector. Avoid using too much heat when soldering. Be especially careful to avoid shorting adjacent pins together.

2.2 Let's Receive Some Signals

This is the step you have been waiting for! Connect the receiver to an antenna and turn it ON.

For this test, we are going to use the special "SEARCH" mode of PC-AMTOR. For those of us familiar with AMTOR, the HAL "SEARCH" mode is a super-version of AMTOR LISTEN mode. In "SEARCH" mode, PC-AMTOR examines all signals received and makes its own decision about the code, mode, speed, and polarity of the signal you receive. AMTOR ARQ, AMTOR FEC, AMTOR SEL-FEC, BAUDOT RTTY, ASCII RTTY, and CW are automatically selected for reception, at the right speed and polarity.

To start SEARCH mode:

1. Press [F1] (enter command mode)
   The first COMMAND menu will be shown with **CODE** highlighted.
2. Press [Enter]
   The CODE menu will be displayed.
3. Press the [Down-arrow] key to highlight **SEARCH**
4. Press [Enter]
   PC-AMTOR is now in SEARCH mode.

That's all there is to setting up the software.

There is one "special key" to remember:

[F10] always resets SEARCH mode.

Use it if SEARCH does not at first choose the correct code and rate (we aren't perfect) or each time you tune a new signal.

Now, set the receiver to LSB or FSK mode and tune it to a RTTY signal. Try 14.080 to 14.100 Mhz. There are generally a lot of Baudot RTTY signals in this frequency range. The SPT-2 accessory makes receiver tuning very simple, but you can also do it "by ear" with some practice. If you don't have a tuning indicator, some "cut-and-try" work will be necessary. When a valid RTTY signal has been received, you will see the code and speed indicated on the top and center line status indicators. Practically all amateur RTTY uses Baudot code at 45 or 74 baud (60 or 100 WPM). If LSB or FSK is used on the receiver, the amateur polarity should be "NORM" (normal).

After RTTY has been mastered, tune down to 14.070 to 14.080 and find a pulsed AMTOR signal. AMTOR uses the same tones as RTTY. Again, using the SPT-2 makes it very easy to get proper receiver tuning. AMTOR tuning takes some patience as it takes time for PC-AMTOR to become synchronized to the received AMTOR signals. Note that there are two types of pulsed AMTOR signals - those with "long" pulses, and those with "short" pulses. You will get printable characters from only the "long" pulsed signals. After some practice, you will see print from some pulsed AMTOR signals. This is AMTOR-ARQ mode, sometimes called "Mode A". You may see some errors, skipped spaces, or repeated characters. This is normal and due to the fact that you are only listening and not linked with the error-correcting station.

AMTOR also has the "FEC" mode of transmission. This sounds very much like RTTY, but is a little faster than normal and does not have the characteristic "rhythm" of Baudot RTTY. FEC also uses the same tones and shift as RTTY and AMTOR-ARQ. AMTOR-FEC takes even more patience when monitoring a signal. Tune the signal correctly and then quit tuning! Give PC-AMTOR (and FEC) a chance!

Finally, try CW. CW will be easier to tune if you first try standard CW receive mode and then return to SEARCH mode after practicing CW tuning. To change to CW mode, type [F1], [Enter], use the [Arrow] keys to highlight to "CW", and type [Enter] again. You will now be in CW mode.

Set the receiver to CW mode. Use the SSB filter to start and then switch to a narrow receiver filter only if conditions require it. The PCI-3000 CW tone filters are set for a center frequency of 800 Hz, the "standard" CW output tone from most receivers when the narrow filter is used. Tune to a clean and strong CW signal - one that has little interference for now. The SPT-2 makes it very easy to tune CW signals. There is also an on-screen flashing star (*) right next to the "CW" mode indicator. This star should be ON for each key-down pulse and OFF when the sending station's key is open. CW receive speed is automatically tracked and displayed right next to the star.

PC-AMTOR includes another CW tuning aid that you may prefer to use. Type [Alt]-C to turn the CW receive side-tone ON. This side-tone is at 800 Hz and synchronized with the detected CW signal. Tune the receiver so that the CW tone matches that of the PC side-tone and you have "perfect tuning".

You have now tried all the receive modes of the PC-AMTOR. At any time, you can elect to manually select a receive mode by simply typing [F1], and choosing the desired mode, code, speed, and polarity from the menu items. Practice using both the SEARCH and manual mode/code selections.

Now, tune to a long-winded rag-chew and READ THE REST OF THIS CHAPTER and the OPERATOR'S GUIDE. When you get tired of reading, tune around and get familiar with the receive modes of PC-AMTOR. Don't forget, Alt-H always gets you a HELP screen.

2.3 PC Hardware Compatibility

PC-AMTOR and its PCI-3000 circuit board should be compatible with any truly "IBM-compatible" Personal Computer with the following minimum capabilities:

1. The PC must be "IBM-compatible" and use the MS-DOS or PC-DOS software operating system (V2.0 or higher).

2. The PC model may be "PC-XT", "PC-AT", PC-286, or PC-386.

3. Most versions of "Turbo" models should work. If problems are experienced when a PC is operated in "Turbo" mode, try the "standard" speed mode. PC-AMTOR does NOT need the extra speed of a "Turbo" mode.

4. The PCI-3000 circuit board requires a "full-length" plug-in slot that is approximately 14" long. It cannot be used in computers that do not meet size standards for PC accessories. The Tandy 1000 series of PC's and most "lap-top" PC's do not have full-length accessory slots.

5. The PCI-3000 circuit board may be plugged into any fully-supported accessory slot. Some PC's do not include all bus signals on the "far-right" plug-in slot (adjacent to the power supply and disk drives in most cabinet arrangements). Do not use this "last slot" for the PCI-3000 unless your manual indicates that this bus connector is "fully-supported".

6. The PC should have "IBM-compatible" ROM BIOS routines, bus connector, and interrupt routines. If your PC runs standard PC software and plug-in cards, it probably does have these compatible features.

7. A minimum of 512K of RAM (Random Access Memory) is recommended.

8. The PC should have a minimum of two floppy disk drives OR one floppy disk drive and one hard disk. The floppy disk drives may be either 360K or 1.2MB 5.25" units. HAL disks for 3.5", 740K "mini-floppy" diskettes are also available upon request. The hard disk may be any size.

9. The PC video card and CRT monitor may be "Hercules-compatible" monochrome, "CGA" color, "EGA" color, or "VGA" color. If computer RFI is found to be a problem, a monochrome video card and CRT may greatly reduce RFI. PC-AMTOR automatically senses which video option you have and requires no special video set-up program. Colors may be set in the CONFIGURATION menu as explained in Chapter 3.

10. The PC may include a "full complement" of serial and parallel I/O cards. Standard "COM1" and "COM2" serial I/O ports will work without interference. In general, non-standard "COM3", "COM4", or more serial I/O expansion cards may also work without interference, but a careful reading of the expansion card manual may be necessary to assure that it and the PCI-3000 are not accidentally set to the same I/O address. The PCI-3000 I/O address may be changed to avoid such a conflict. (See APPENDIX B.)

11. PC-AMTOR assumes use of a standard parallel printer device connected to "LPT1". Printer ON/OFF is controlled through the PC-AMTOR configuration menu. [Shift]-[Prtsc] may also be used but it may not reproduce all on-screen graphics of PC-AMTOR.

12. The PCI-3000 interface to the PC-bus is "I/O mapped". The PCI-3000 does not require use of "standard" I/O address or interrupt assignments. Further, the I/O address of the PCI-3000 has been intentionally assigned to "un-used" locations. If conflicts do occur, the PCI-3000 includes a six-section DIP switch that may be used to set a range of PC I/O addresses used. This address is set to "260H" on all PCI-3000's shipped from the factory. If you have problems with running the PCI-3000 and suspect an I/O conflict, a close reading of APPENDIX B is recommended. The PCI-3000 I/O address may be changed to avoid conflicts. However, a change will not generally be necessary. PC-AMTOR software automatically searches for the PCI-3000 circuit board and adjusts its address to match the hardware.

2.4 PC Software Compatibility

PC-AMTOR is written for single-user, dedicated PC use. It is assumed that when you are running PC-AMTOR, you are also not at the same time expecting the PC to do other tasks. However, under some conditions, PC-AMTOR may also run quite well in a "window" or "multi-task" PC operating system. HAL has made no effort to preclude any of these multi-task uses. However, it is beyond the scope of this product for HAL to support PC-AMTOR in any but a single-user operating environment.

The PCI-3000 does, however, include special provision for multi-task operation with APLink and PC-based mailbox programs. In this case, the special "Host Port" of the PCI-3000 is used to control and communicate with the PCI-3000 circuit board. The PC-AMTOR program is not used in this case. Rather, the PCI-3000 "Host Port" is connected to the serial I/O port required by APLink or the mailbox software and all control and character exchange is via this port. When "Host Port" is used, the menus, screens, and programmable features of PC-AMTOR software are therefore not available; all such features are of course furnished by APLink or the mailbox program. Complete details of the "Host Port" are contained in Chapter 4 of this REFERENCE MANUAL.

The "Host Port" may be used with any other terminal program that is 100% compatible with the specific command set listed in Chapter 4. Experienced programmers may also wish to try writing their own terminal software using Host port commands.

Some PC users find it convenient to use "DOS SHELL" programs. These are utility programs in which you may list the programs you frequently use, select them from an on-screen menu, and run that program without having to use DOS commands to change directories, load programs, etc. A DOS Shell may in fact make it even simpler to run PC-AMTOR. However, a "DOS Shell" may also automatically load other programs which interfere with some features of PC-AMTOR. There are many varieties of "DOS Shell" programs available, some good, and some "not so good". Try running PC-AMTOR without the DOS Shell first and make sure it works properly. If it does, then try using your DOS Shell. If problems develop, change your DOS Shell program or run PC-AMTOR without using the Shell program.

Some PC users also make use of memory resident utility programs (also called "TSR" programs). Typical uses of such programs may be to scroll the CRT screen, check spelling, or redirect video for an application program. A resident program is typically loaded as part of the AUTOEXEC.BAT program and stays resident in RAM thereafter. It may or may not work properly with PC-AMTOR. It may use memory space that is required by PC-AMTOR, causing loss of features of either PC-AMTOR or the resident program. It is impossible to predict whether or not a given memory resident program will or will not work with PC-AMTOR. HAL suggests that you first try PC-AMTOR with all resident programs removed and then try adding each resident program one-by-one to test for compatibility. HAL cannot guarantee operation with any resident programs.

2.5 Radio System Connections

All PCI-3000 I/O connections are made to the 25-pin connector on the rear panel. This connector is a standard DB-25S (female pins) style, like those used for the PC's printer connection. However, pin connections to the PCI-3000 are NOT in any way the same as those used for the parallel printer.

> *Avoid confusing the PCI-3000 connector with other DB-25 connectors that may also be used on your PC!*

Radio (and host port) connections to the PCI-3000 may be made directly to the PCI-3000 or through the SPT-2 SPECTRA-TUNE accessory. The SPT-2 "fans-out" all radio connections to "RCA-style phono connectors" that are much more convenient to use than direct connection to the PCI-3000. The HAL PCI-EXT and SPT-1 accessories for the PCI-2000 are also directly compatible with the PCI-3000. If you already have these models, they may be used with your PCI-3000.

Connections (a) directly to the DB-25 connector, and (b) using the SPT-2 will be described in the following sections.

2.5.1 Direct Connections to the PCI-3000

The pin, signal, and limitations of each signal are shown in Table 2.1. A careful study of this table is highly recommended before you start soldering wires!

The limits should be compatible with practically all modern amateur transmitters and receivers. *DO NOT EXCEED THESE LIMITATIONS.*

When preparing a cable for direct connection to the PCI-3000 DB-25 connector, HAL recommends the following guidelines:

1. Use SHIELDED cable, preferably one with a braided shield. Connect the shield wire to one of the GND pins (10, 12, or 25).

2. Use a metal or conductive plastic connector shell. Be sure that there is a good electrical connection between the shell and the metal body of the DB-25 connector.

3. If you use the Host Port, provide a separate shielded cable for Host Port signals. Connect the shield to one of the GND pins (10, 12, 25).

4. Use a small soldering iron when soldering wires to the DB-25 connector. The connector's plastic insulation is easily melted.

5. Keep the cable length as short as possible to minimize RFI. 10 feet is the recommended maximum length for use in a radio station.

A typical direct connection to an amateur radio station is shown in Figure 2.1. AMTOR/RTTY transmit may be connected for either "AFSK" audio tones (LSB transmit mode) or "FSK" using the FSK input on some transceivers. Refer to APPENDIX C for specific details about FSK connections and jumper selections.

TABLE 2.1
PCI-3000 I/O CONNECTIONS

PIN	NAME	FUNCTION	I/O	LIMITS	NOTE
1	AF IN	Audio from receiver	Input	10V p-p	
2	TXD	Host Port RS-232 Data Input	Input	±12 VDC	1
3	RTS	Host Port RS-232 Request-To-Send	Input	±12 VDC	1
4	SELCAL	AMTOR SEL-CAL Output	Output	+50V @ 100ma	
5	DCD	Host Port RS-232 Carrier Detect	Output	±12 VDC	1
6	SPACE	AMTOR/RTTY Tuning CRT Output	Output	10V p-p	
7	MARK	AMTOR/RTTY Tuning CRT Output	Output	10V p-p	
8	CW/RTTY	Mode switch output for SPT-2	Output	TTL (+5/GND)	
9	(n/c)	No Connection	(n/c)		
10	GND	Signal Ground	(Gnd)		2
11	FSK	AMTOR/RTTY FSK Output	Output	TTL or RS-232	4
12	GND	Signal Ground	(Gnd)		2
13	+KEY	CW Key Output (Same as pin 24)	Output	±50V @ 100ma	3
14	PTT	Transmitter Push-to-Talk Output	Output	±50V @ 100ma	
15	DTR	Host Port RS-232 Data Terminal Ready	Input	±12 VDC	1
16	RXD	Host Port RS-232 Data Output	Output	±12 VDC	1
17	CTS	Host Port RS-232 Clear-To-Send	Output	±12 VDC	1
18	AF OUT	AMTOR/RTTY Audio to Transmitter	Output	-30dBm (200mV)	
19	CWLED	CW LED Signal to SPT-2	Output	LED to GND	
20	DSR	Host Port RS-232 Data Set Ready	Output	±12 VDC	1
21	+12V	+12 VDC to SPT-2	Output	+12 V,100 ma	5
22	-12V	-12 VDC to SPT-2	Output	-12 V,100 ma	5
23	+5V	+5 VDC to SPT-2	Output	+5 V,100 ma	5
24	-KEY	CW Key Output (Same as pin 13)	Output	±50V @ 100 ma	3
25	GND	Signal Ground	(Gnd)		2

NOTES:

1. Host Port connections are discussed in Chapter 4.

2. Any or all of the GND pin connections (pins 10, 12, and 25) may be used as required. Be sure to leave one pin for Host Port connection.

3. Two CW KEY Outputs are supplied (pins 13 and 24). In the PCI-3000, a high speed relay is used for CW output to key either polarity of transmitter key line. Separate pins are provided to maintain compatibility with the PCI-EXT and SPT-1 accessories.

4. Using the FSK output requires selection of the FSK signal polarity and TTL or RS-232 levels with jumpers on the PCI-3000 circuit board. See APPENDIX C for recommended settings for various transceiver models.

5. PC power supply voltages (pins 21, 22, and 23) are provided only for use by the SPT-2. Do not attempt to use these voltages to power other accessories.

6. Be sure to run a good RF ground between the PC and your radio system!

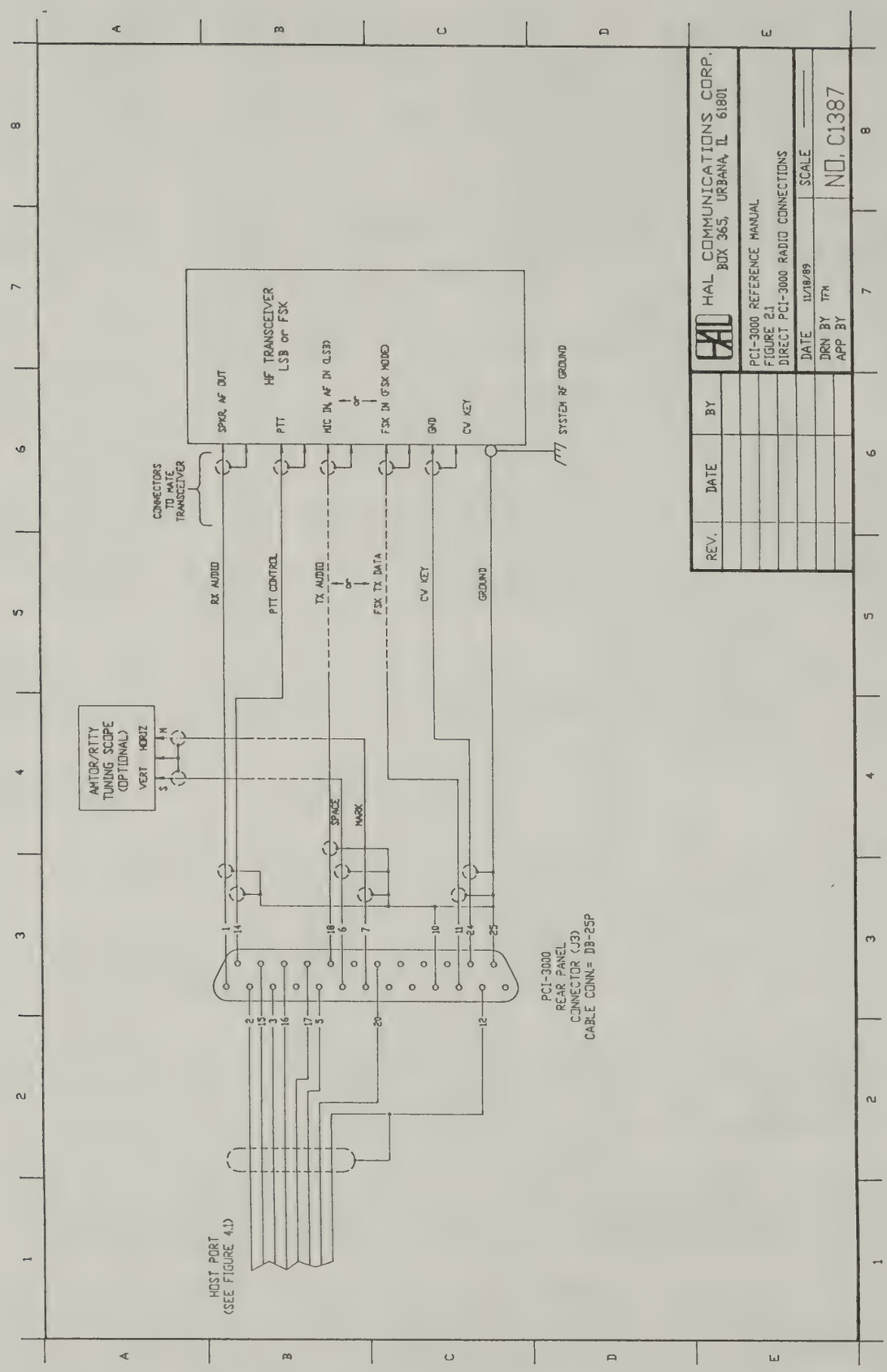

Figure 2.1 Direct PCI-3000 Radio Connections

2.5.2 Connections Using the SPT-2 SPECTRA-TUNE

The HAL SPT-2 SPECTRA-TUNE accessory serves two purposes: (1) a very accurate CW, AMTOR, and RTTY tuning indicator, and (2) "fan-out" of radio and Host Port connections to more "user-friendly connectors. The SPT-2 in fact combines the features of the previous HAL PCI-EXT and SPT-1 products in addition to some new tuning indicator features. The SPT-2 gives the simplest of the three possible ways to connect your radio equipment to the PCI-3000 circuit board.

All SPT-2 radio connections are made via standard "RCA-type" phono connectors. Many radios now include these same style connectors on their rear panels. If so, PC-AMTOR connection is very simple. In this case, standard audio "phono patch cables" may be purchased at your local HI-FI or radio store and just plugged-in. Some radio equipment may require adapters or special connectors that may also be obtained from your local store or from the transceiver manufacturer (or his dealer).

If you use "HI-FI" cables, try to choose a high-quality cable that is well-shielded. This usually means not buying the cheapest cable available. However, it is NOT necessary to buy "gold-plated connectors" or "super-cables". In severe RFI situations, these cables might help, but they are very expensive. Careful attention to RF grounds is a MUCH better (and less expensive) approach!

The SPT-2 rear panel also includes a DB-25 connector just for connection to the Host Port. Use of the Host Port is discussed in detail in Chapter 4.

The SPT-2 includes a 6 foot DB-25P to DB-25S patch cable. Connect this cable between the PCI-3000 rear panel and the SPT-2 PCI-3000 connector. Other than a good PC cabinet RF ground, this is the ONLY connection required to the PCI-3000.

The "FIL-1" Receive Filter accessory may be installed inside the SPT-2. This filter adds extra selectivity for AMTOR and RTTY reception. The filter center frequency is 2210 Hz (1360 Hz for export versions). The FIL-1 accessory may be used in place of or in addition to any IF filters you may also have inside your receiver. If you have purchased the "FIL-1" accessory, this is the time to install it!

The connections and limitations for the SPT-2 are shown in Table 2.2. A typical SPT-2 connection diagram is shown in Figure 2.2.

TABLE 2.2
CONNECTIONS USING THE SPT-2

SPT-2 CONNECTOR	FUNCTION	I/O	LIMITS	TYPICAL RADIO CONN.	NOTE
RX AUDIO	Audio from Receiver	Input	10V p-p	EXT SPKR PHONE PATCH OUT	
TX AUDIO	Audio to LSB Xmiter	Output	30mV rms	MICROPHONE IN PHONE PATCH IN	1
PTT	Push-To-Talk Signal	Output	+50V, 200ma	MICROPHONE PTT XMIT CONTROL STBY CONTROL	
FSK	FSK Transmit Data	Output	TTL/RS-232	FSK INPUT RTTY DATA IN	1
KEY	CW Transmit Key	Output	±50V, 100ma	CW KEY HAND KEY	2
SEL-CAL	SEL-CAL Signal	Output	+50V, 100ma	See APPENDIX A	3
M	MARK CRT Output	Output	10V p-p	Optional	
S	SPACE CRT Output	Output	10V p-p	Optional	
GND	RF Ground	(Gnd)	GROUND	GND	
HOST PORT	Host Port RS-232		±12 VDC	See Chapter 4	4

Notes:

1. AMTOR and RTTY may be transmitted using either "AFSK" with the transmitter in "LSB" mode or "FSK" using the "FSK Input" and "FSK Mode" if it is available on your radio equipment. Using FSK mode requires setting two jumpers on the PCI-3000 circuit board (polarity and TTL/RS-232). Refer to APPENDIX C for a discussion of FSK option selection.

2. Either positive or negative voltage CW key lines may be keyed by the PCI-3000. Be sure to choose a "hand-key" input to your transceiver and NOT a special "squeeze-key" input that may be provided on some transceivers.

3. Using the SEL-CAL output may require special modifications of your radio equipment. See APPENDIX A for more details.

4. Connection to the Host Port is discussed in detail in Chapter 4.

5. Be sure to make a good ground wire connection between the SPT-2 GND terminal and the radio RF ground system.

This completes installation of the PCI-3000 and PC-AMTOR software.

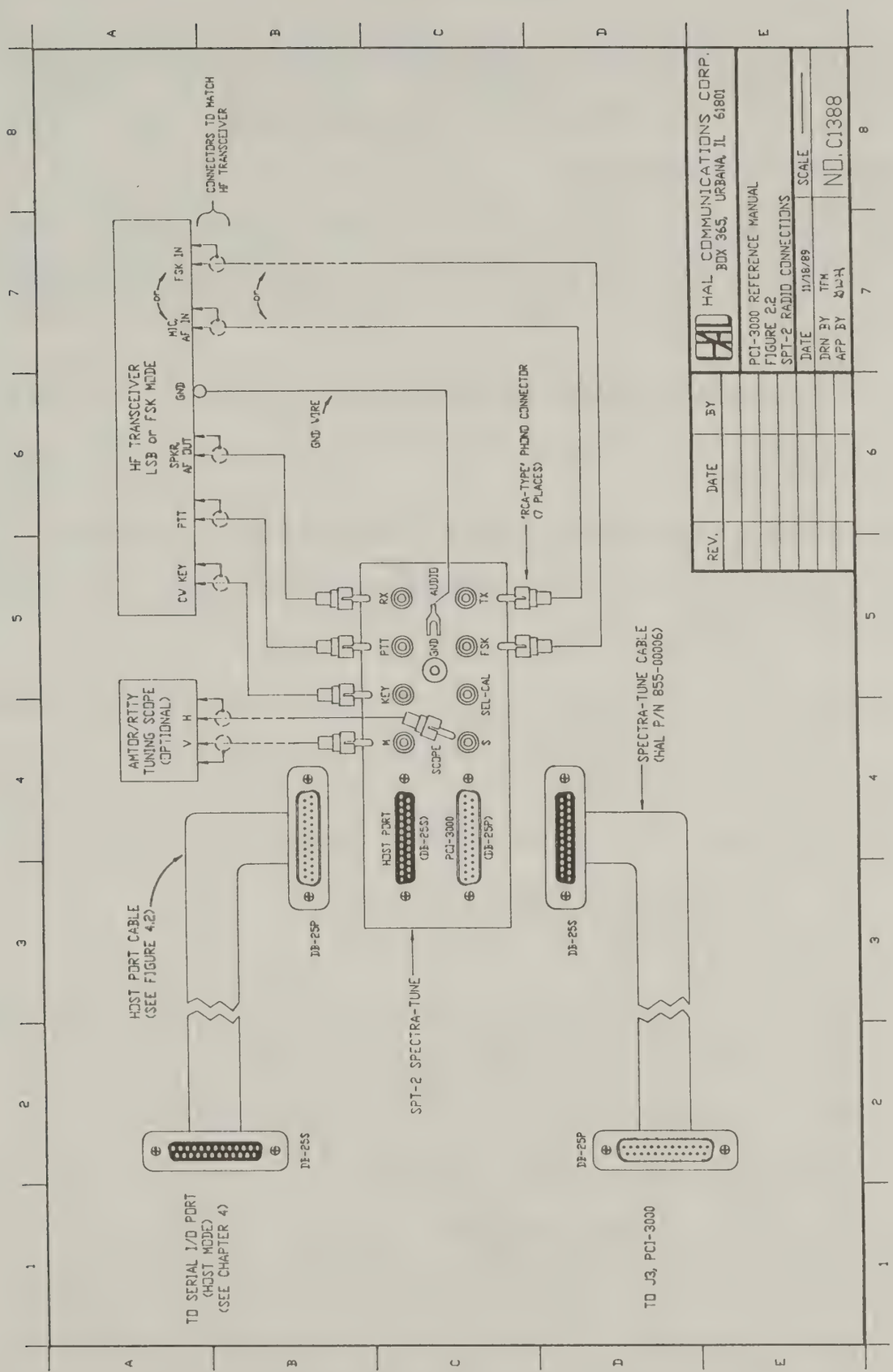

Figure 2.2 SPT-2 Radio Connections

CHAPTER 3
OPERATION

This Chapter describes use of PC-AMTOR software in detail. The PC-based software is supplied on a single 5.25" floppy diskette. Please refer to Section 2.1 of the previous Chapter for installation instructions.

3.1 Keystrokes and Nomenclature

When PC-AMTOR software is run in your personal computer, it uses the standard "IBM-Compatible" keyboard. Keyboards are now available in many varieties, but the labeling systems used in this manual is compatible with all currently known variations. The following manual conventions will be used to make it clear which keys should be used:

1. All user-entered keystrokes are underlined.

2. If a letter is to be typed as a command, it may be either lower case or UPPER CASE.

3. Multi-letter keytop labels are shown in [BRACKETS]. For example:

   [Enter], [F1], [F8], [Ctrl], [Alt], [Shift], [Home], [PgUp], etc.

   Each [BRACKETED] set represents one key to be pressed.

4. Some keys must be held down while pressing a second key. These will be shown with a dash (-) between key presses.

   For example: **[Alt]-C**

   This notation should be interpreted as;

   press and hold the **[Alt]** key
   press and release the **C** key
   release the **[Alt]** key

5. The personal computer itself includes an automatic repeat feature if keys are held down for longer than 1/2 second. *Be careful to avoid holding a printing key down for longer than is required.*

6. Separate sequential command entries are separated by commas.

   For example: [F1], M implies:

   press and release the **[F1]** key
   press and release the **M** key.

3.2 PC-AMTOR Command Entry

All PC-AMTOR commands are entered in one of three ways:

1. Type [F1] to show the command menus. Use [arrow keys], [Enter], and [Space bar] to choose options; type [Esc] to back up one menu step.

2. Type "Hot-keys": [Alt]-Q, [Shift]-[F6], for example.

3. An "expert user" may use single-letter command abbreviations once [F1] is typed to enter command mode. For example, [F1], M enters command mode and selects the Mode menu window. The appropriate "expert" key associated with each command is shown in the command windows. The "expert user" may speed type the entire command sequence without waiting for each command menu to be displayed.

The use of command menus and "hot keys" is discussed in the OPERATOR'S GUIDE. The "expert user" will soon discover his own set of often-used key sequences.

3.3 PC-AMTOR Screens

PC-AMTOR uses several screen formats to display send and receive text and to allow control of the many features available. Each screen format is unique and easily recognized. The following is a brief over-view of the screen formats you will see. Succeeding sections will discuss each mode and feature in detail.

3.3.1 Title Screen and Version Numbers

When you first start PC-AMTOR, the title screen shown in Figure 3.1 will be displayed. Note the two Version numbers - one for PCI-3000 ROM "firmware" and one for the PC-AMTOR diskette. Write these numbers down. If you call HAL, we will need to know both Version numbers.

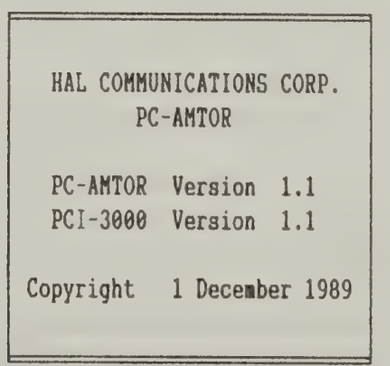

Figure 3.1 PC-AMTOR Title Screen

3.3.2 Operating Screen

After a short time, the title screen of Figure 3.1 will be automatically replaced by the standard operating screen shown in Figure 3.2. If you do not want to wait for the title screen to clear itself automatically, just type [ENTER] and PC-AMTOR will rapidly change to the operating screen.

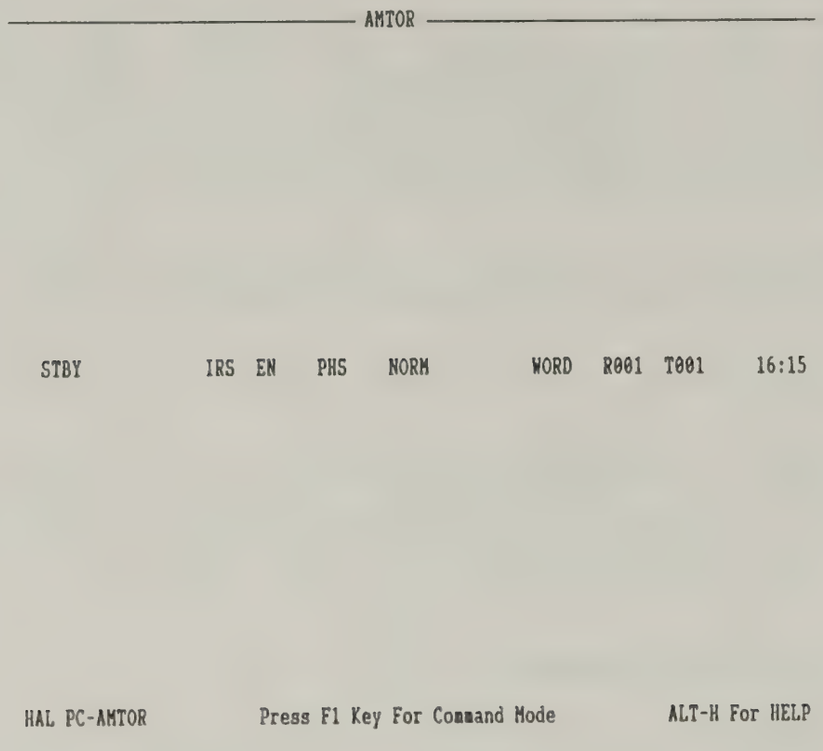

FIGURE 3.2 Operating Screen

The operating screen is split into two text areas. The upper-half shows received text and the lower half shows text to be transmitted. The two halves are separated by a single line that shows current operating codes, mode, and other parameters related to operation. The top line of the screen shows selected mode and file information (when file storage or loading is in use). The very bottom line *always* shows brief HELP information. At the start of operations, the message **Press F1 Key For Command Mode** always appears.

The receive (upper 11 lines) and transmit (lower 10 lines) screen areas may be thought of as "adjustable windows" within the much larger receive and transmit text buffers. The receive buffer is 250 lines long and the receive section of the screen may be "scrolled" to view any 11-line segment of that buffer. Similarly, the transmit buffer is also 250 lines long and the lower section of the screen may also be positioned to view any ten-line segment of the transmit buffer. Use of the two buffers is discussed in more detail in Section B of the OPERATOR'S GUIDE.

3.3.3 Command Mode Screen

Type the [F1] key to enter COMMAND mode and view the COMMAND menu screens. The COMMAND menus generally appear on the lower half of the screen - in the position normally used to display transmit buffer text (CONFIGURATION menus require the full screen).

All COMMAND menus are accessed by first pressing [F1] and then using the [arrow] keys and [Enter] keys to select further menus and parameters.

The [Esc] key always "backs-up" one menu level. Use one or more [Esc] key presses to exit the COMMAND menu and return to the operating screen. The opening COMMAND menu is shown in Figure 3.3

IMPORTANT:

> *Accessing a COMMAND menu does not stop reception of text or transmission if transmission is in progress when the menu is accessed. This means that all reception continues even while you may be changing parameters and may not be able to view the receive buffer. Similarly, if you start transmitting and then access a COMMAND menu, the previously typed text will continue to be transmitted. However, you cannot type new transmit text until you have exited the COMMAND menu.*

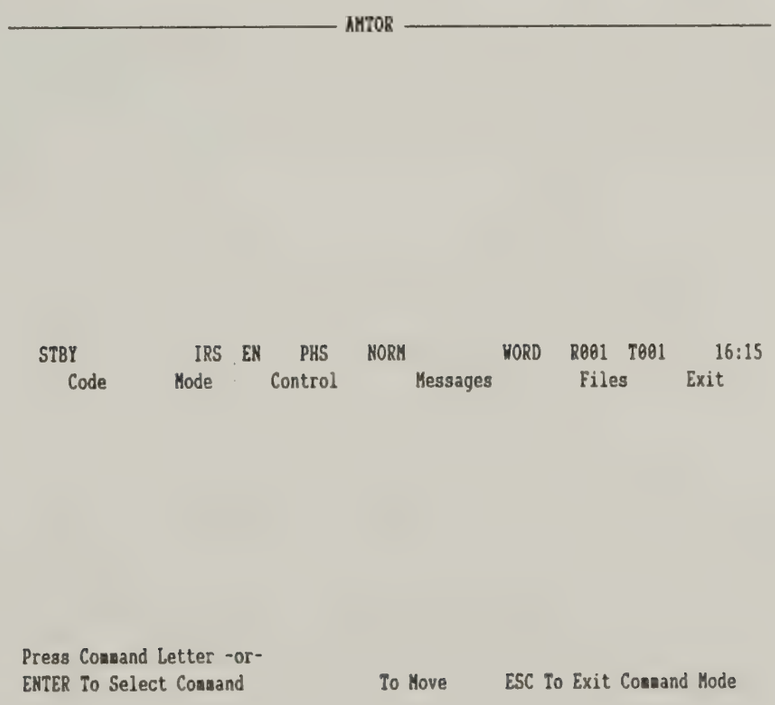

Figure 3.3 Opening COMMAND Menu

The COMMAND menu adds a second center information line with **Code** highlighted. To change the operating Code, press [Enter]. To select other parameters to change, use the [right-arrow] or [left-arrow] keys to highlight the desired feature and then type [Enter]. Typing [Enter] for any of the highlighted second-line parameters will always produce a detailed "pull-down window" menu. The [arrow] keys and [Enter] or [Space Bar] are then used to select or change parameters within a pull-down window.

IMPORTANT:

1. Typing [F1] always enters COMMAND mode
2. A second center status line indicates COMMAND mode
3. Exit COMMAND mode by typing the [Esc] key
4. You cannot enter transmit text while in COMMAND mode
5. Select additional menus or parameters using the [arrow keys
6. A parameter is not changed until you type [Enter] or [Space Bar]
7. Some parameters are "toggled" by typing [Space Bar]
8. Type [Esc] to back-up one COMMAND level.

The above items will be explained in greater detail in Section 3.4.

3.4 Command Menus

PC-AMTOR includes many changeable modes and features. Each change requires access to COMMAND mode by typing the [F1] key. Once in COMMAND mode, all further keyboard operations are interpreted as control or change operations -- NOT as text to be transmitted. Commands are split into six major categories: CODE, MODE/RATE, CONTROL, MESSAGES, FILES, and EXIT. These categories will be discussed in detail in the following sections.

3.4.1 CODE

The CODE menu allows selection of the send/receive data codes of PC-AMTOR. The CODE menu may be accessed by first entering command mode (type [F1]) and then either typing **C** or by positioning the screen highlight to **CODE** and then typing [Enter]. The CODE menu screen is shown in Figure 3.4.

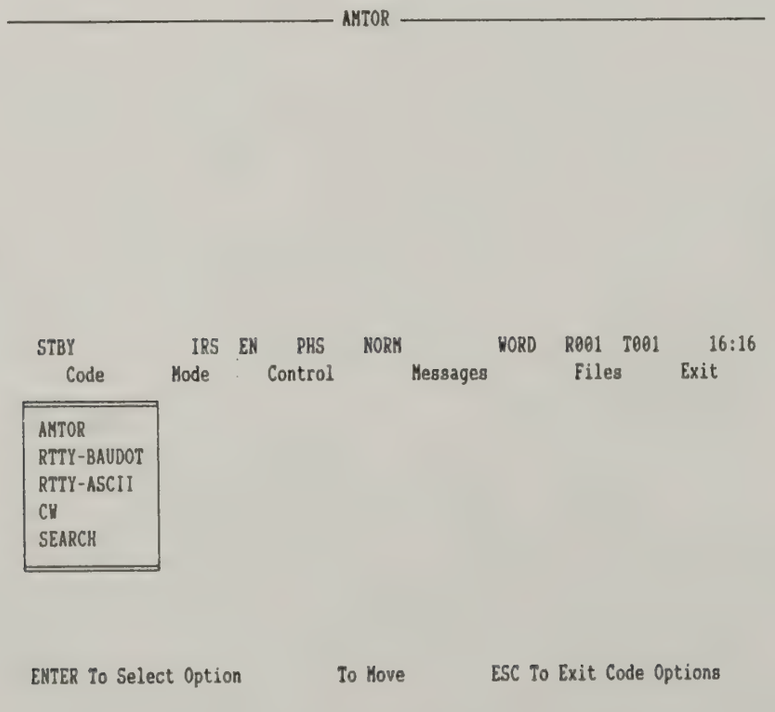

FIGURE 3.4 CODE Menu

AMTOR, RTTY-BAUDOT, RTTY-ASCII, CW, and SEARCH codes may be selected. Each code is described in detail in Sections D through G of the OPERATOR'S GUIDE. A new code is selected by first positioning the highlight bar on the desired code and then typing [Enter]. Selection of a code may also require further option choices in additional menus as will be explained shortly.

3.4.2 MODE/RATE

The MODE/RATE menu allows selection of features related to the code chosen. Note that AMTOR has only one rate (100 baud), but has various modes that may be selected (ARQ, FEC, SEL-FEC, LISTEN, STANDBY). Conversely, RTTY-BAUDOT and RTTY-ASCII codes have five different data rates to choose from (45, 50, 57, 74, and 110 baud). In CW, the RATE menu allows entry of the sending WPM speed. Therefore, the function of the second menu changes with the code selected. To access the MODE/RATE menu, you must first be in command mode (type the [F1] key) and then either move the highlight bar to **MODE** or **RATE** and type [Enter] or type the key letter (**M** for Mode, **R** for Rate). Typical MODE/RATE menus are shown in Figure 3.5. Note that the contents of this menu are *different* for each code selected.

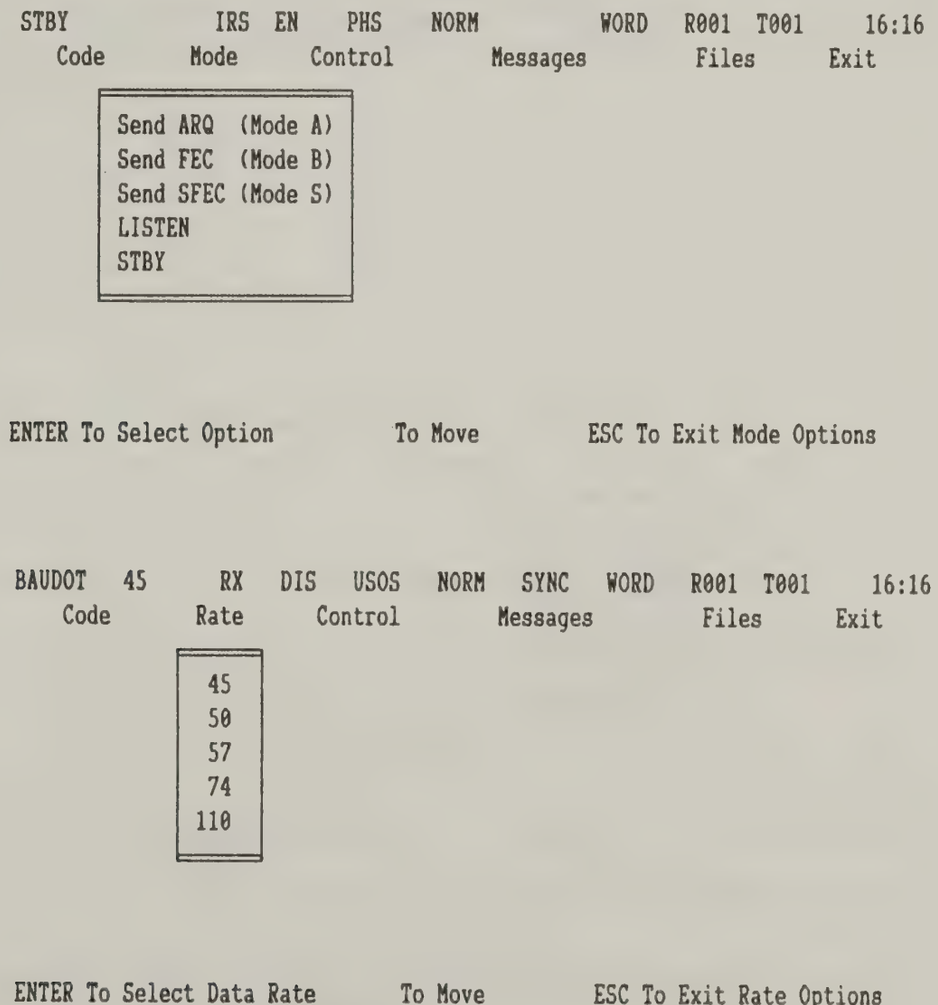

Figure 3.5 MODE/RATE Menus

3.4.3 CONTROL

The CONTROL menu allows selection of various control parameters for each mode. As in the case of the MODE/RATE menu, the options available vary with the code selected. The CONTROL menu may be accessed by first entering command mode (type [F1]) and either typing **O** (Control) or by positioning the highlight bar to **CONTROL** and then typing [Enter]. In this menu, each option may be independently enabled or disabled as desired. There are two possible states for each option in this menu. To change an option, use the up/down arrows to position the highlight bar and then type [Space Bar] to toggle through the available choices. The parameter is changed each time you type [Space Bar]. You may then either choose additional options to be changed or exit the CONTROL menu by typing [Enter] or [Esc]. A typical RTTY-BAUDOT CONTROL menu is shown in Figure 3.6.

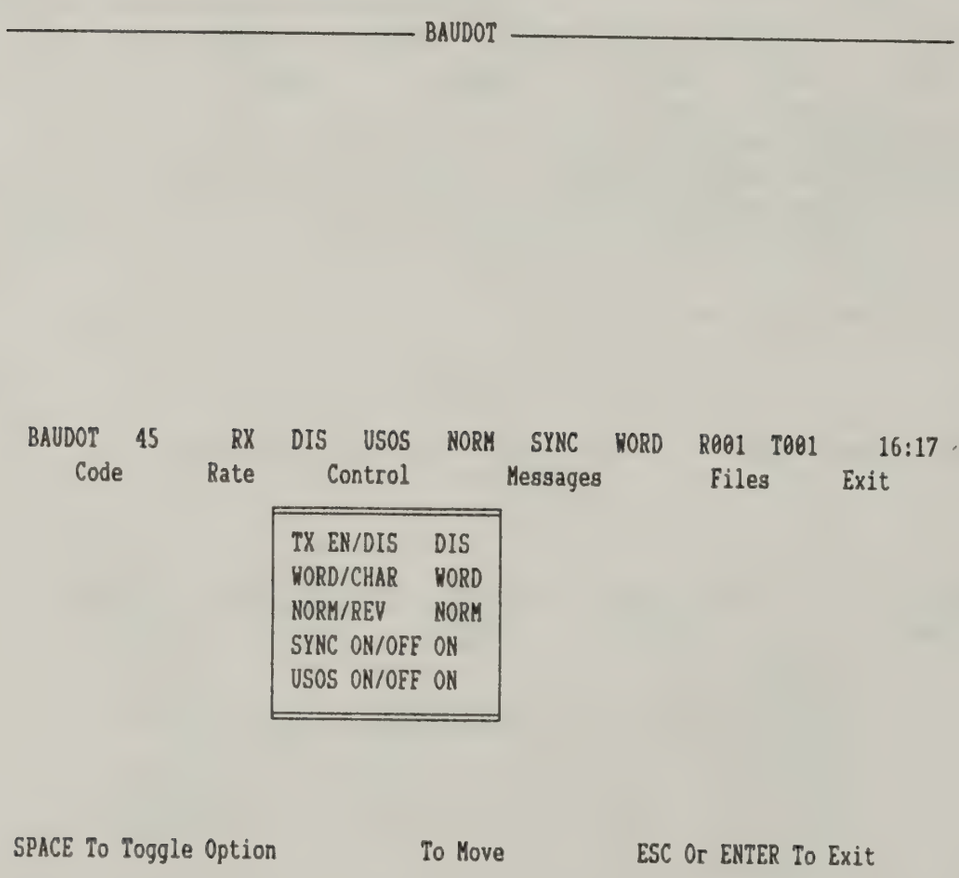

FIGURE 3.6 CONTROL Menus

3.4.4 MESSAGES

The MESSAGES menu allows access to programmable messages such as your **ID**, the other station's **CALL**, or general purpose **HERE IS** messages . You can either SEND these messages or enter (program) new text to be stored. This menu is the same for all codes and modes of PC-AMTOR. The following definitions apply:

ID: your call sign.
CALL: the other station's call sign

When sending, you have the option of sending **ID** (*your* call sign), **CALL** (*other station's* call sign), or **CALL + ID** (other station's call plus your call sign). When a SEND option is chosen, the chosen text stream is loaded into the transmit buffer and COMMAND is immediately exited. As will be discussed in Section 3.5, special "HOT KEYS" are also provided for speedy access to these message features. These messages may also be accessed and changed by using the CONFIGURATION menu.

As for other COMMANDS, the [Esc] key may be used to "back-up" to a previous command level or to exit COMMAND mode entirely. A typical MESSAGES menu is shown in Figure 3.7.

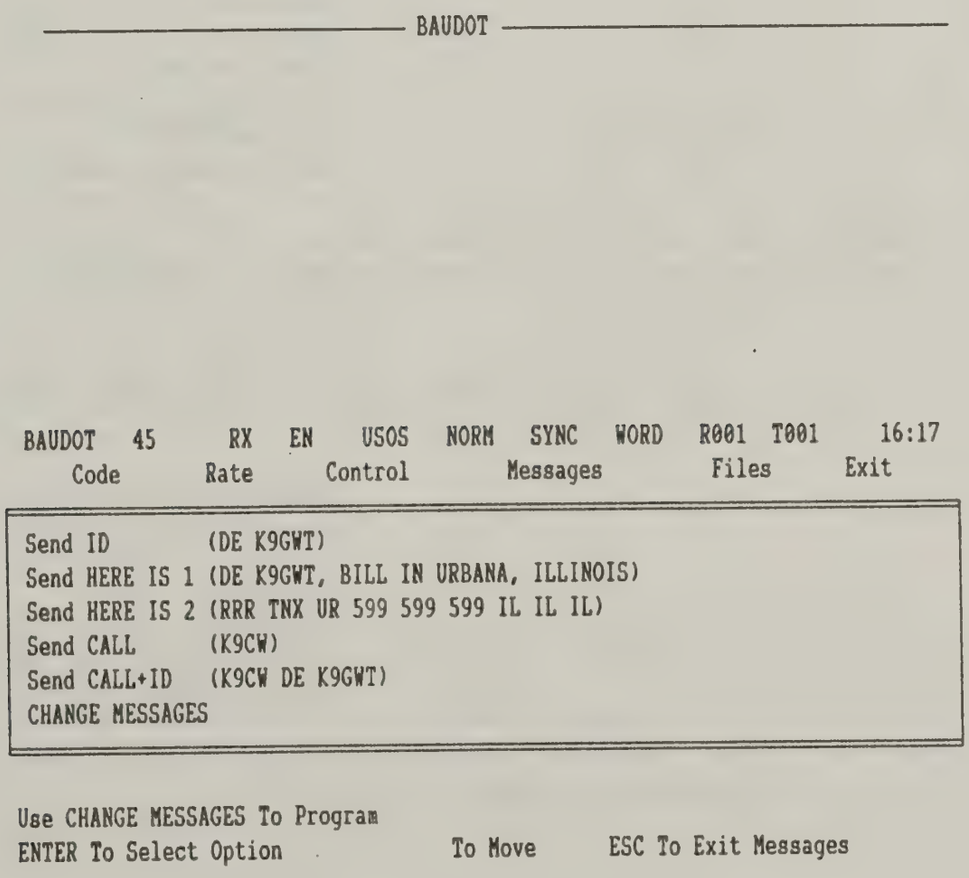

FIGURE 3.7 MESSAGES Menu

3.4.5 FILES

The FILES menu provides access for file storage and retrieval. This menu is accessed by moving the highlight bar to **FILES** and typing [Enter] or by typing the key letter **F** after entering command mode. Files may be transmitted either directly from the disk or by first loading the files into the screen transmit buffer. The **Save To Disk** option triggers a second screen menu for selection of which data is to be saved. Receive text may be saved to disk as either one long "continuous" file or as a series of "sequential" files. In addition, portions or "blocks" of either the receive or transmit buffer may also be saved to disk. The **Directory** option allows viewing of the current file directory. A "path" option allows viewing of other sub-directories on a hard disk. The last option of this menu - **CONFIGURATION** - allows access and changes to turn-ON default settings and to a number of infrequently changed operating parameters (such as AMTOR delay values). Two CONFIGURATION screen "pages" may be viewed.

Save To Disk and Send From Disk operations are discussed in Section 3.8 of this manual. Use of the CONFIGURATION menu and file is discussed in Section 3.7. A typical FILES menu is shown in Figure 3.8.

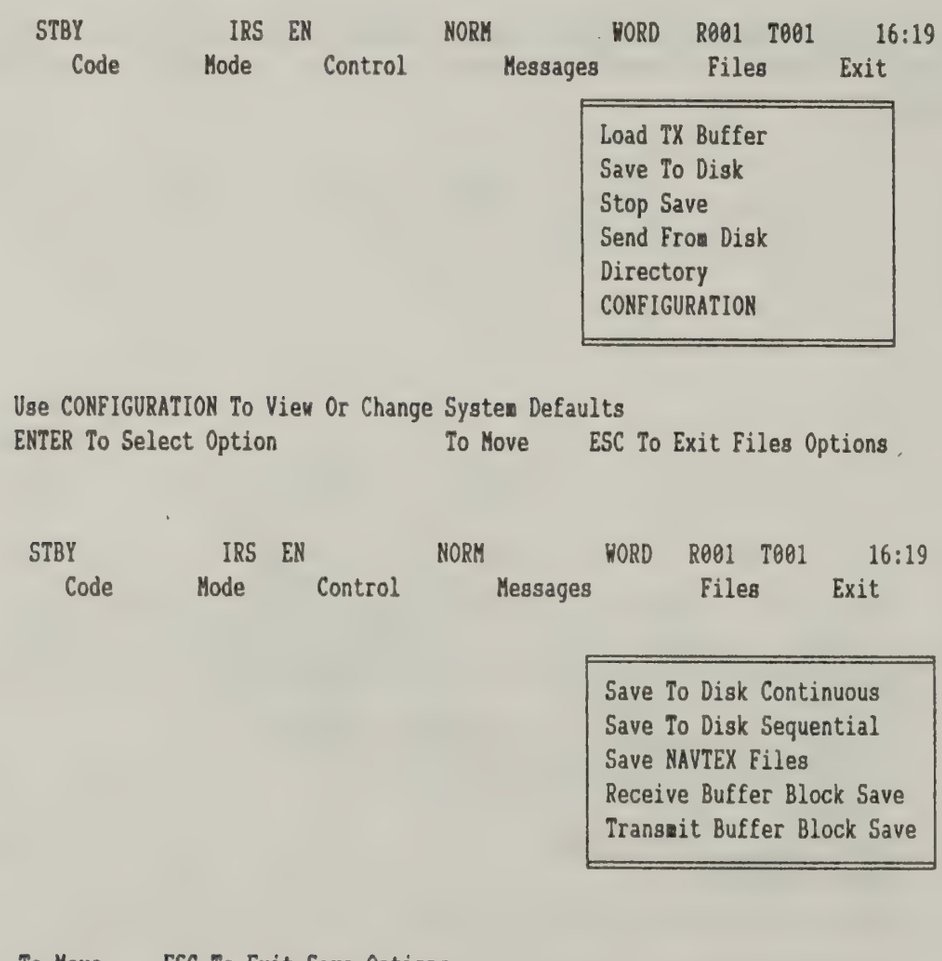

FIGURE 3.8 FILES Menu

3.4.6 EXIT

The EXIT menu has just one option - Save Current Configuration (Y/N)? Electing Y will store all the current CONFIGURATION file settings in the PCA.CNF file to be used the next time you run PC-AMTOR. Typing N will not save any changes you have made in the CONFIGURATION menu pages and you will use the previous PCA.CNF parameters the next time you run PC-AMTOR. Section 3.7 discusses use of the CONFIGURATION menu and PCA.CNF files. As in other commands, you can avoid exiting PC-AMTOR by using [Esc] to "back-out" of the **EXIT** menu.

3.4.7 Horizontal Command Menu Selection

PC-AMTOR command menus are arranged in a vertical format - choosing the CONTROL menu provides a vertical list of options. You may then highlight the desired option, type [Space Bar] to "toggle" the option, type "ESC" to return to the command line, and then highlight other commands and modes to select. You may also move *horizontally* from one menu to the other without having to return to the command line. Use the left and right arrow keys to move horizontally. You may use horizontal movement to quickly scan which options are available for a given mode.

NOTE: An option is NOT selected or changed until after you have highlighted that option and pressed [Space Bar] or [Enter]. Horizontal movement between menus does not cause selection of options that may be highlighted as you scan through each menu.

3.5 Special Keys

Like all PC programs, PC-AMTOR makes use of some special key combinations for rapid control. However, unlike other programs, "special keys" have been minimized so that you do not have a whole "dictionary" of strange key combinations to memorize. Our special keys require no more than two key tops to be held down at a given time. The "Function Keys" (those labeled [F1], [F2], etc. through [F10]) are used for "hot key" operations - operations that you will use frequently while on the air. Some of these "hot key" operations duplicate items you may also control through the command menu, but using a "hot key" will be faster. Other keys, such as [Alt]-H for "HELP" and [Alt]-Q to send the "QUICK BROWN FOX ..." test message have become standards for all HAL communications products.

3.5.1 HELP - [Alt]-H

This is a "magic key" on all HAL Communications software packages. It may be used at any time that PC-AMTOR is NOT in Command mode. The HELP screen replaces the normal operating screen of PC-AMTOR, but it does not interfere with reception or sending that may be in progress. If you cannot recall what key is required to do an operation, type [Alt]-H. Note that there are three HELP screens available. The HELP screens are shown in Figure 3.9.

```
FUNCTIONS KEYS                          Page 1 of 3

KEY  Fn              Alt-Fn              Ctrl-Fn
---  --------------  ------------------  ----------------
F1   Command Mode    Command Mode        Command Mode
F2   Send CALL + ID  ...                 Change AMTOR RC
F3   Send CALL       ...                 Change Call
F4   Send ID         Send CW ID          ...
F5   Send HERE IS 1  ...                 Change HERE IS 1
F6   Send HERE IS 2  ...                 Change HERE IS 2
F7   AMTOR Over      AMTOR Forced Over   ...
F8   AMTOR End       AMTOR Forced End    ...
F9   AMTOR Mode A    ...                 ...
F10  Reset SEARCH    TX Enable           TX Enable

Press [ENTER] to Continue, [ESC] to Exit
```

```
HOT KEYS                                        Page 2 of 3

 KEY   Description              KEY   Description
-----  ----------------------   -----  ----------------------
Alt-A  Change Code Speed        Alt-P  Set Print Squelch
Alt-B  Send TIME + DATE         Alt-Q  Send QBF Message
Alt-C  Toggle CW Receive Tone   Alt-R  Select RX Buffer
Alt-D  Send DATE                Alt-S  Toggle CW Transmit
Alt-E  Send WRU ANSWERBACK      Alt-T  Send TIME
Alt-G  Toggle PRINTER ON/OFF    Alt-U  Clear RX Buffer
Alt-L  Forced LTRS (RX Buffer)  Alt-V  Clear TX Buffer
Alt-M  Send <<<<<<<<<<<<        Alt-X  Select TX Buffer
Alt-N  Toggle Normal/Reverse    Alt-Z  Send MARS Time Group

Shift-Prtsc  Print Screen

Press [ENTER] to Continue, [ESC] to Exit
```

```
EDIT KEYS                                       Page 3 of 3

 KEY         FUNCTION
----------  ------------------------------------------------------
Alt-F       Reformat paragraph
Alt-K       Delete the entire line and move all text up one line
Alt-W       Delete the word under the cursor and shift all text left
Ctrl-Left   Move left one word
Ctrl-Right  Move right one word
PgUp        Move up one page (10 lines, toward line 1)
PgDn        Move down one page (10 lines, toward line 250)
Home        Move to the beginning of the line
End         Move to the end of the line
Ctrl-Home   Move to line 1 column 1
Ctrl-End    Move to last text line in transmit buffer
Ins         Toggle between INSERT and OVER-STRIKE modes

Press [ENTER] to Continue, [ESC] to Exit
```

FIGURE 3.9 HELP SCREENS

3.5.2 FUNCTION Keys

PC-AMTOR uses function keys [F1] through [F10]. Some keyboards also include [F11] and [F12]. PC-AMTOR does not use these keys. A Function key is used either by itself, or with the [Alt] or [Ctrl] key. The operation of each Function key is shown in Table 3.1. Note that many possible combinations are NOT used. This is intentional to minimize confusion.

TABLE 3.1
FUNCTION KEYS

KEY	OPERATION
[F1]	Go to COMMAND mode
[Alt]-[F1]	Go to COMMAND mode
[Ctrl]-[F1]	Go to COMMAND mode
[F2]	Send CALL + ID (other station's call + your call)
[Alt]-[F2]	Not Used
[Ctrl]-[F2]	Change AMTOR SEL-CAL for Other Station (REMOTE CALL)
[F3]	Send CALL (other station's call sign)
[Alt]-[F3]	Not Used
[Ctrl]-[F3]	Change CALL (other station's call sign)
[F4]	Send ID (your call sign)
[Alt]-[F4]	Send ID in CW
[Ctrl]-[F4]	Not Used
[F5]	Send HERE IS 1
[Alt]-[F5]	Not Used
[Ctrl]-[F5]	Change HERE IS 1
[F6]	Send HERE IS 2
[Alt]-[F6]	Not Used
[Ctrl]-[F6]	Change HERE IS 2
[F7]	Send AMTOR OVER (insert +? in transmit buffer)
[Alt]-[F7]	Force AMTOR OVER (force OVER when you are IRS)
[Ctrl]-[F7]	Not Used
[F8]	Send AMTOR END Signal (insert "ZZZZ" in transmit buffer)
[Alt]-[F8]	Force AMTOR End ("Panic kill")
[Ctrl]-[F8]	Not Used
[F9]	Send AMTOR ARQ (Mode A)
[Alt]-[F9]	Not Used
[Ctrl]-[F9]	Not Used
[F10]	Restart SEARCH mode
[Alt]-[F10]	Transmit Buffer Enable/Disable
[Ctrl]-[F10]	Transmit Buffer Enable/Disable

NOTE: The [F1] key always enters COMMAND mode.

3.5.3 Other Special Keys

Various other [Alt]- and special keys are used by PC-AMTOR. Their use is shown in Table 3.2.

TABLE 3.2
SPECIAL KEYS

KEY	OPERATION
[Alt]-A	Advance RTTY Data Rate
[Alt]-B	Insert Time and Date into Transmit Buffer
[Alt]-C	CW Receive Side-tone ON/OFF
[Alt]-D	Insert Date into Transmit Buffer
[Alt]-E	Insert WRU ANSWERBACK message in Transmit buffer
[Alt]-F	Reformat current paragraph (edit)
[Alt]-G	Printer ON/OFF Toggle
[Alt]-H	Show HELP Information
[Alt]-K	Delete Line (edit)
[Alt]-L	Force LETTER case in AMTOR & Baudot Receive
[Alt]-M	Send <<<<<<<<<<<< (12 x Baudot LTRS)
[Alt]-N	NORM/REV RTTY Polarity Toggle
[Alt]-P	Set RTTY Print Squelch
[Alt]-Q	Insert "THE QUICK BROWN FOX ..." message in TX buffer
[Alt]-R	Shift Screen Scroll Controls to Receive Buffer
[Alt]-S	CW Transmit Side-tone ON/OFF
[Alt]-T	Insert Time into Transmit Buffer
[Alt]-U	Clear Receive Buffer (NOT Recoverable!)
[Alt]-V	Clear Transmit Buffer (NOT Recoverable!)
[Alt]-W	Delete Word (edit)
[Alt]-X	Shift Screen Scroll Controls to Transmit Buffer
[Alt]-Z	Send Time/Date Group in Military format
[Shift]-[PrtSc]	Print Current Display Screen
[Esc]	Back-up One Step in Command Menus
[Left-arrow]	Move Cursor Left 1 Character (edit)
[Ctrl]-[Left]	Move Cursor Left 1 Word (edit)
[Right-arrow]	Move Cursor Right 1 Character (edit)
[Ctrl]-[Right]	Move Cursor Right 1 Word (edit)
[Up-arrow]	Move Cursor Up 1 Line (edit)
[Down-arrow]	Move Cursor Down 1 Line (edit)
[PgUp]	Move Cursor Up 1 Page (10 lines) (edit & RX Buffer)
[PgDn]	Move Cursor Down 1 Page (10 lines) (edit & RX Buffer)
[Home]	Move Cursor to Beginning of Line (edit)
[Ctrl]-[Home]	Move Cursor to Beginning of Buffer (edit & RX Buffer)
[End]	Move Cursor to End of Line (edit)
[Ctrl]-[End]	Move Cursor to End of Buffer (edit & RX Buffer)
[BS] ([Ctrl]-H)	Delete Character to Left of Cursor (edit)
[Back-arrow]	Delete Character to Left of Cursor (edit; same as BS)
[Del]	Delete Character at Cursor (edit)
[Ins]	Toggle Between INSERT and OVERTYPE Edit Modes (edit)

3.6 Programmable Messages

PC-AMTOR includes several different programmable call signs, ARQ SEL-CAL codes (SELECTIVE CALL), HERE IS messages, and ARQ WRU ANSWERBACK message. The following tables explain the various messages that may be programmed using Page 2 of the CONFIGURATION menu (type [F1], F, C, D to access page 2).

TABLE 3.3
MESSAGES

LABEL	USE
ID	The call sign of *your* station (DE K9GWT, for example) (16 characters maximum; include "DE" if you want it to be sent).
CALL	The call sign of the *other* station (K9CW, for example) (16 characters maximum)
HERE IS 1	A custom message you may wish to send frequently (60 characters maximum)
HERE IS 2	A custom message you may wish to send frequently (60 characters maximum)

TABLE 3.4
AMTOR CALLS

LABEL	USE
LC 476	The 4-letter ARQ SEL-CAL for *your* station (ex: KGWT) (4 letters required; *no numbers*)
LC 625	The 7-letter ARQ SEL-CAL for *your* station (ex: KIGWTXX) (7 letters required; *no numbers*)
GROUP CALL	The 4-letter SFEC SEL-CAL for *your* station (ex: CQCQ) (4 letters required; *no numbers*)
ANSWERBACK	Response message from *your* station to an ARQ WRU call. (32 characters maximum; ex: QRA K9GWT KGWT)

TABLE 3.5
CALL DIRECTORY

LABEL	USE
LAST	SEL-CAL and Call Sign of *last called other station*
RC1	SEL-CAL and Call Sign of 1st Call Directory station
RC2	SEL-CAL and Call Sign of 2nd Call Directory station
RC3	SEL-CAL and Call Sign of 3rd Call Directory station
RC4	SEL-CAL and Call Sign of 4th Call Directory station
RC5	SEL-CAL and Call Sign of 5th Call Directory station (4 or 7 letters only for SEL-CAL) (16 characters maximum for call signs)

These messages are accessed in several different ways. All are displayed and may be programmed from the CONFIGURATION Menu (Page 2). In addition, the CALL DIRECTORY parameters may be programmed when you choose the "SEND ARQ" COMMAND menu option.

3.6.1 "Hot-Key" Message Access

The "current" set of SEL-CAL and Call Sign messages may be programmed or sent using "hot keys" as shown in Table 3.6.

TABLE 3.6
"HOT-KEY" MESSAGE ACCESS

"HOT-KEY"	OPERATION
[F2]	Load **CALL** plus **ID** into transmit buffer. Example: **K9CW DE K9GWT**
[Ctrl]-[F2]	Program *other station's* ARQ **SEL-CAL**. Example: **KKCW**
[F3]	Load **CALL** into transmit buffer (*his* call sign)
[Ctrl]-[F3]	Program **CALL** (*his* call sign) Example: **K9CW**
[F4]	Load **ID** into transmit buffer (*your* call sign).
[Alt]-[F4]	Load **CW ID** into transmit buffer (*your* call sign). Example: **DE K9GWT**
[F5]	Load **HERE IS 1** into transmit buffer.
[Ctrl]-[F5]	Program **HERE IS 1.** Example: **QSL UR RST 599 599 599 IN IL IL IL**
[F6]	Load **HERE IS 2** into transmit buffer.
[Ctrl]-[F6]	Program **HERE IS 2.** Example: **CQ CQ CQ DE K9GWT K9GWT KGWT KGWT**

The [F2] key is particularly useful since it combines both call signs (his and yours) into one identification phrase. You may choose to send only your call (ID) by using the [F4] key or his call (CALL) by using the [F3] key.

Also, note that CALL (the other station's call sign) is easily changed using "hot keys" [Ctrl]-[F3]. You only need to enter the other station's call sign - and *not yours* when programming. This makes for very convenient "contest mode" operation.

The [HERE IS] "hot-keys" are very useful for CQ messages and contest standard form reports. The CQ call example (HERE IS 2) illustrates the recommended format to be used when calling CQ in AMTOR FEC mode.

3.6.2 Your Station Parameters:

Since parameters for your station will not change frequently (if ever), these parameters are programmable only via the MESSAGES and CONFIGURATION menus. When first starting PC-AMTOR, you will therefore want to immediately go to the the MESSAGES or CONFIGURATION menu (page 2) and set the text for your station. We suggest the formats shown in Table 3.7

TABLE 3.7
LOCAL STATION MESSAGE EXAMPLES
(Local Call Sign = K9GWT)

PARAMETER	CONTENTS	EXAMPLE
ID	DE [your call sign]	**DE K9GWT**
HERE IS 1	[information 1]	**DE BILL, K9GWT, URBANA, IL**
HERE IS 2	[information 2]	**QSL UR RST 599 599 599 IL IL IL**
LC 476	[4-letter ARQ SEL-CAL]	**KGWT**
LC 625	[7-letter ARQ SEL-CAL]	**KIGWTXX**
GROUP CALL	[4-letter SFEC SEL-CAL]	**CQCQ**
ANSWERBACK	[ARQ WRU response]	**QRA K9GWT KGWT**

Selection of AMTOR calls is further explained in Chapter D of the OPERATOR'S GUIDE. Once these parameters have been programmed, select the "SAVE CONFIGURATION" menu option and type [Enter]. PC-AMTOR will now be customized for your station and will always start using these messages.

3.7 CONFIGURATION Menu and Files

PC-AMTOR provides access to many different option settings, many of which may not require frequent changes. Also, a separate "CONFIGURATION" file, PCA.CNF, is used to store your desired start-up parameters and messages. All of the parameters and messages may be accessed through the CONFIGURATION menus reproduced in Figures 3.10 and 3.11.

3.7.1 CONFIGURATION Menus

Use the following procedure to access the CONFIGURATION menus:

1. Type [F1] to enter COMMAND menu
2. Type [left-arrow] twice or type F to highlight **Files**.
3. Type [Enter]
4. Type [Up-arrow] once to highlight **Configuration**
5. Type [Enter]

You will be shown Page 1 of the CONFIGURATION menu (see Figure 3.10). The top row of menu boxes lists all of the "special" parameters related to the four codes - AMTOR, BAUDOT, ASCII, and CW. The lower three boxes allow adjustment of SYSTEM parameters, DISPLAY COLORS, and additional CONFIGURATION menu operations.

Type [Down-arrow] once and then [Enter] to view Page 2 of the CONFIGURATION menu (Figure 3.11). This page lists all of the programmable messages discussed in Section 3.7. All messages may be modified and stored using this menu as well as by the other methods discussed in Section 3.6.

Return to Page 1 by again selecting **Display Next Page** ([Down-arrow] once followed by [Enter].

Each of the many parameters may be changed by first selecting **Edit Configuration** and typing [Enter]. The four arrow keys may then be used to highlight desired options to be changed. The [left-arrow] and [right-arrow] keys move the highlight cursor between major boxes ("horizontally"), and the [up-arrow] and [down-arrow] keys provide movement within a menu box.

To change a parameter, first use the arrow keys to highlight it. Two methods are used to change parameters. In cases where there is only a fixed set of variations, use the [Space Bar] to "toggle" or progressively increment through the available choices. Other parameters such as AMTOR "TD" require entry of a number followed by [Enter]. The prompt line at the bottom of the screen will tell you which procedure must be followed.

When a parameter is changed, the change has two effects:

1. The parameter is immediately changed for operation

2. The CONFIGURATION file will store the new setting if Y (Yes) is answered in **Exit** (see Section 3.4.6).

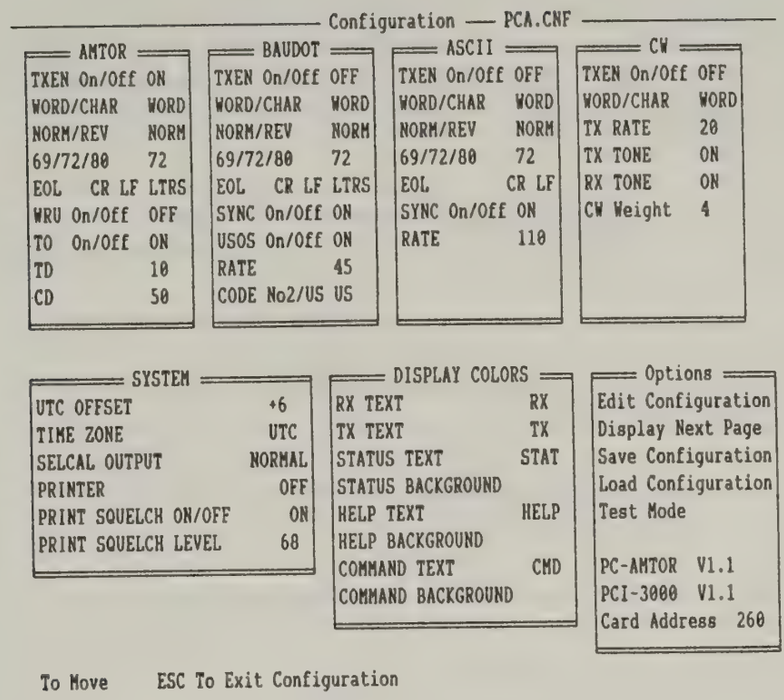

Figure 3.10 CONFIGURATION Menu (Page 1)

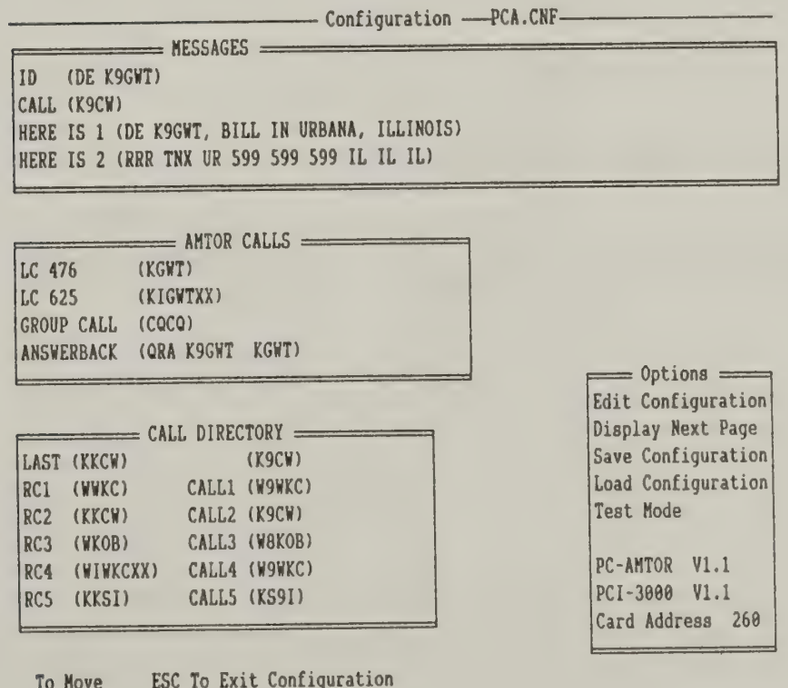

Figure 3.11 CONFIGURATION Menu (Page 2)

3.7.2 CONFIGURATION Files

Some parameters may be changed both in the CONFIGURATION menu and by using COMMAND mode - BAUDOT rate for example. All changes made via the COMMAND and RATE menus can be saved in the PCA.CNF file upon exit. Changes made in the CONFIGURATION menu are also saved on **Exit** -- if you choose to do so. The CONFIGURATION menu parameters determine the *default* values that will be used when you start PC-AMTOR.

Likewise, changes made to programmable messages on Page 2 of the CONFIGURATION menu affect both the messages stored for immediate use and the messages that will be stored as the default values in the PCA.CNF file.

PC-AMTOR normally saves your default configuration in a file named "PCA.CNF". This is your choice when you **Exit** PC-AMTOR - Y or N to store the current CONFIGURATION in PCA.CNF.

However, when you use the **Save Configuration** option on Page 1 of the CONFIGURATION menu, you have the option of naming your own special configuration file. You may use any name, but PC-AMTOR will always attach ".CNF" as the file extension. This feature allows you to create "custom" configuration files, tailored to different uses of PC-AMTOR. For example, you could have one file called "AMTOR.CNF" for AMTOR use and another called "MARS.CNF" for MARS traffic use.

You can load "custom" configuration files in two ways:

1. Run PC-AMTOR normally, select the CONFIGURATION Menu, the **Load Configuration** option, and choose your new ".CNF" file.

2. When loading PC-AMTOR, include the ".CNF" configuration file name.

An example of the second approach is:

C:\PCA>PCA AMTOR.CNF [Enter]

This is a "stream-lined" method to load PC-AMTOR using other than the standard PCA.CNF configuration file. You may create as many custom ".CNF" files as you wish.

3.7.3 Mode-Specific Configuration Parameters

Page 1 of the CONFIGURATION menu allows setting of a number of special parameters for each code used in PC-AMTOR. Some of these parameters, such as TX buffer control, and NORM/REV may also be set using COMMAND mode menus. Others, such as AMTOR delays, transmit line length, and UTC clock offset may only be set using the CONFIGURATION menu. Some options are repeated for each code. This allows custom setting of these parameters to different values for each code. For example, you could have a 69 character transmit line for AMTOR, 72 characters for Baudot and 80 characters for ASCII. Please refer to Figure 3.10 for the following discussions.

3.7.3.1 AMTOR Configuration Parameters

Nine parameters may be set for AMTOR mode. The first three - "TXEN On/Off", "WORD/CHAR", and "NORM/REV" are also set using the Control main command menu. Regardless of which menu is used to set these items, the change is immediate. Saving the Configuration will preserve the new settings for next use of PC-AMTOR.

The remaining 6 AMTOR parameters may only be set using the Configuration menu.

Transmit line length may be set to three values - 69, 72, or 80 characters. The international standard for AMTOR is 69 characters. This parameter specifies the maximum number of characters that may appear in a transmitted line of text before PC-AMTOR will automatically insert a new line sequence. If WORD mode is also selected, a word at the end of a line will be "wrapped-around" and not be split -- these lines will of course be shorter than 69 characters.

The **EOL** parameter sets the **E**nd **O**f **L**ine control character sequence transmitted at the end of each line. Four options are available for AMTOR:

CR only, CR LF, CR LF LTRS, and CR CR LF

CR = Carriage Return LF = Line Feed LTRS = Letters Shift

Use the [Space Bar] key to "toggle" through the options.

HAL recommends that you use "CR LF LTRS" for AMTOR.

Only AMTOR ARQ mode uses the WRU option. If WRU is turned ON, you will also need to program an ANSWERBACK message on Page 2 of the Configuration menu (see Figure 3.11). Operation of the WRU feature is discussed in detail in Section D.1.9 of the OPERATOR'S GUIDE. As mentioned in this discussion, set WRU OFF unless you specifically need WRU ANSWERBACK.

AMTOR ARQ mode also includes a **T**ime **O**ut" (**TO**) feature. If TO is set ON, this limits the number of calls or re-tries in ARQ mode to approximately 90 seconds. If TO is set OFF, ARQ will continue calling until you manually end the link. This operation is discussed in detail in Section D.1.3 of the OPERATOR'S GUIDE. The "normal" setting is to have TO turned ON.

Two AMTOR ARQ mode time delays may be set: **Transmit Delay (TD)** and **Control Delay (CD)**. Both delays are set by entering two digits, approximately equal to the time delay in milliseconds.

Transmit Delay (**TD**) is the time between switching PTT to transmit and the actual start of transmit data output. This can be adjusted to compensate for transmitters that switch slowly. *Use this parameter with care as setting too high a value will restrict the maximum distance over which you can communicate in AMTOR ARQ mode.*

HAL recommends a TD setting of 10.

Control Delay (**CD**) is related to how quickly you send a CS1/CS2 control signal response when you are the IRS station. CD is the time delay between the end of the received pulse and your transmitted response. CD allows you to compensate for the *other station's receiver delay* - a high value is more tolerant of a slow receiver *at the other station.* This delay can affect *both* your minimum and maximum communications range. If you have trouble communicating over a short distance, a *higher* setting of CD may be appropriate. However, increasing CD also *decreases* your maximum communications range. For general purpose HF communications:

HAL recommends a CD setting of 50.

3.7.3.2 BAUDOT Configuration Parameters

As in the case for AMTOR, "TXEN", "WORD/CHAR", and "NORM/REV" may also be set using the main Command menus.

The U.S. standard for Baudot transmit line length is 72 characters. However, the U.S. NAVY MARS and European standard is a 69 character transmit line length. Set this parameter to meet your requirements.

Again as in AMTOR, the BAUDOT **E**nd **O**f **L**ine (**EOL**) sequence may be set to five control sequences: **CR, CR LF, CR LF LTRS, and CR CR LF.**

HAL recommends a BAUDOT EOL sequence of CR LF LTRS.

U.S. NAVY MARS requires use of CR CR LF with *no* LTRS for EOL.

The Baudot "SYNC On/Off" parameter controls the "synchronous idle" or "diddle" feature. When ON, the Baudot LTRS character will be transmitted when the transmit buffer output "catches up" with your typing. This feature is discussed in Section E.4.4 of the OPERATOR'S GUIDE.

HAL recommends that both WORD and SYNC options be ON for BAUDOT RTTY.

The **U**n**S**hift **O**n Space (**USOS**) parameter is discussed in Section E.4.5 of the OPERATOR'S GUIDE. When set ON, this feature may reduce miss-prints caused by noisy conditions.

HAL recommends that USOS be set ON.

Baudot rate may also be set in the Configuration menu. This has the same effect as using the main RATE menu or by using the [Alt]-A "Hot Key".

Finally, there are two recognized Baudot character sets in use. The differences are outlined in Section E.7.3 of the OPERATOR'S GUIDE. Unless you require the CCITT No. 2 combination,

HAL recommends using the U.S. Baudot character set.

3.7.3.3 ASCII Configuration Parameters

ASCII parameters are very similar to those discussed for Baudot. The standard ASCII transmit line length may be 69, 72, or 80 characters, depending upon the application.

HAL recommends using an ASCII line length of 72 characters.

The ASCII End Of Line (EOL) sequence may be set to **CR** only or **CR LF**. For HF radio communications,

HAL recommends using CR LF for the ASCII EOL sequence.

The ASCII synchronous idle ("diddle") character is the "NULL" (00H).

HAL recommends that ASCII SYNC and WORD be set ON.

3.7.3.4 CW Configuration Parameters

The first five CW parameters may also be set via the main menu or by using "hot keys" as discussed in Section F of the OPERATOR'S GUIDE.

CW transmit weight is set ONLY through the Configuration menu. CW weight is discussed in Section F.3.1 of the OPERATOR'S GUIDE. This is a single digit parameter between "0" and "8". A weight setting of "4" gives the standard 3/1 dash/dot weight ratio. Numbers less than "4" give a "light" weight (shorter dots and dashes); greater than "4" for "heavy weight".

HAL recommends that CW weight be set to "4".

3.7.3.5 SYSTEM Configuration Parameters

This menu box controls a number of "other" system parameters - time, printer, ARQ SEL-CAL, and Print Squelch. Print Squelch setting may also be made using the [Alt]-P "hot key" as described in Section E.8 of the OPERATOR'S GUIDE.

PC-AMTOR uses the clock built into your PC. Time is displayed on the status line and may be sent using the "hot-keys" shown in Table 3.2. While most users set their PC's to show "local time", most of us want to display and send "universal time" on HF radio. The "UTC OFFSET" parameters allows setting of an hour OFF-SET between our local time and "UTC" (also called "GMT" or "ZULU Time"). PC-AMTOR reads this OFF-SET number and adds it to the hours digits of the PC's internal clock.

PC-AMTOR *always* uses a 24-hour time format (1:00PM is "1300"). Day and month transitions caused by adding the OFF-SET are automatically included in PC-AMTOR. Typical OFF-SET numbers for the United States are:

EST:	+5 hours	EDT:	+4 hours
CST:	+6 hours	CDT:	+5 hours
MST:	+7 hours	MDT:	+6 hours
PST:	+8 hours	PDT:	+7 hours

If you wish to display and send the same time as used in your PC, just set the OFF-SET to "0". The OFF-SET may also use a negative OFF-SET; continental Europe would use an OFF-SET of -1 hour.

You may also enter up to four characters to specify the time zone in your transmitted time/date group text. These characters might be: "UTC", "CST", "GMT", "ZULU", etc.

The OFF-SET and time zone characters are also stored in the PCA.CNF file.

Four time and date formats may be transmitted using PC-AMTOR and "hot keys". The following example illustrates the different formats available.

[Alt]-B	Time + Date	1038 UTC 22-NOV-89
[Alt]-D	Date	22-NOV-89
[Alt]-T	Time	1038 UTC
[Alt]-Z	Military Format	221038Z NOV 89

The SYSTEM "PRINTER" option allows ON/OFF control of the PC line printer device. PC-AMTOR assumes that the printer is a standard parallel printer, connected to the PRN1, LPT port. "Hot-Key" [Alt]-G may also be used to turn the printer ON or OFF. When the printer is ON, the letters "LP" will appear on the status line to the left of the time.

> *NOTE: The PC-BIOS is not forgiving if you try to access a printer that is not connected or not enabled. This can appear to "lock-up" your computer! Do not set PRINTER = ON unless you actually do have a printer connected and enabled (Printer ON and "select", "on-line", or "enabled" light ON).*

3.7.3.6 DISPLAY COLORS Configuration Parameters

This option is only useful if you also have a color video display system. PC-AMTOR automatically senses whether you have a monochrome or color display. If monochrome, color options are disregarded. If you have a color monitor, you may wish to experiment with the various combinations. PC-AMTOR senses when a monochrome monitor is connected and limits the available options to those compatible with a monochrome screen.

> *CAUTION! There are color background and text combinations that are very hard - or impossible - to read (red on red, etc). Some combinations may also cause severe eye-strain. Use caution when choosing your colors!*

3.8 File Operations

PC-AMTOR includes file handling so that text files on disk may be transmitted, recorded as received, or created, edited, and stored. The following sections discuss the use of disk files.

PC-AMTOR uses standard MS-DOS and PC-DOS file name conventions. You *may* include disk drive and directory path specifications as part of the file name. Note that file *extensions* should not be entered for **Save To Disk - Sequential** mode; files are *automatically named* in NAVTEX mode. Valid file names are:

TEST	C:/PCA/TEST.TXT	GA57.NAV (NAVTEX File)
TEST.TXT	A:MESSAGES	DATA.007 (Sequential File)
12345678.123	C:/MARS/12JAN90.008	BULLETIN.091

3.8.1 Transmitting Disk Files

Two different mechanisms are provided to send text stored in a disk file. These are:

1. **Load TX Buffer**: Load file into transmit buffer and send text from transmit buffer.
2. **Send From Disk**: Send file directly from the disk without loading into transmit buffer.

3.8.1.1 Load TX Buffer

HAL suggests that the "normal" mode to use is **Load TX Buffer** -- load the disk file into the transmit buffer and then send it just as you would any other transmit text. **Load Tx Buffer** has the following advantages:

1. View all transmit text in the screen buffer before it is transmitted.
2. The text in the disk file is automatically formatted to meet the same transmit line length and send the end-of-line sequences you use for other transmitted text.
3. Once loaded into the transmit buffer, you can then edit any part of the text before it is sent.

3.8.1.2 Send From Disk

However, there are situations in which you will want to send a disk file in exactly the same format as it is stored. RTTY "picture" files with over-prints and files with unusual line formats are good examples. In this case, it is best to use the **Send from Disk** option.

Keep the following points in mind when using **Send From Disk**:

1. The disk text is *not* loaded into the transmit buffer; you cannot view any part of the file until it is sent *and echoed* in the receive buffer.
2. The disk text file is sent *exactly* as recorded and only the end-of-line characters recorded will be sent.
3. The transmit line length is controlled by only the on-disk end-of-line characters and not by any parameters you may set in PC-AMTOR.

4. You cannot edit the text from disk since it is not loaded into the transmit buffer.
5. **Send From Disk** does not work in ARQ mode. Use **Load TX Buffer** to send disk files in ARQ mode.

PC-AMTOR will transmit any disk *text* file, but you should be certain that the file contains only *printable characters.* If you use a word processing program to create a file to be transmitted, use the "ASCII" file print option. Many word processors include special printer format control characters in the file that you will NOT want to send (WordStar "document" files are a good example.) Disk files are loaded into the transmit buffer *after* all other text that has been entered. The transmit buffer has a maximum capacity of 250 lines (approximately 20,000 characters). Any file exceeding the transmit buffer size is truncated in length.

3.8.2 Save Text to Disk Files

PC-AMTOR provides five **Save To Disk** options. These are:

1. **Save To Disk Continuous** - save received text
2. **Save To Disk Sequential** - save received text
3. **Save NAVTEX Files** - save NAVTEX messages in separate files
4. **Receive Buffer Block Save** - save a portion of the receive buffer
5. **Transmit Buffer Block Save** - save a portion of the transmit buffer

3.8.2.1 Save To Disk Continuous

This option saves received text in a disk file. Text "recording" starts when you enter the command and continues until you use the **Stop Save** command. In this mode, *all* received text is saved in *one* long file using the filename you specify. The maximum length of this file is 20,000 characters, approximately equal to the 250 line capacity of the transmit and receive buffers.

The "starting" point of the saved file may be specified to be any line *in the receive buffer.* At the start of **Save To Disk Continuous**, your are asked to highlight the desired start line in the receive buffer. Use the [Up-Arrow] and [Down-Arrow] keys to choose a start line. This feature allows you to "back-up" and save text that has already been saved *as well as continuing text.* If you wish to save only newly received text, just type [Enter] in response to the **Select Save Start Point** prompt.

To use the **Save To Disk Continuous** mode:

1. Press [F1] to enter COMMAND mode
2. Type F to get the **Files** menu
3. Type [Down-arrow] once to get **Save To Disk**
4. Type [Enter]
5. A new menu will be shown; type [Enter]
6. Enter a file name
7. Use the [arrow keys to highlight the desired "start" line.
8. Type [Enter]

OR

7a. Type [Enter] with no "start" specification

To STOP recording:

1. Press [F1] to enter COMMAND mode
2. Type F to get the **Files** menus
3. Type [Down-arrow] twice to get **Stop Save**
4. Type [Enter]
5. Type Y in response to **Stop Store To Disk (Y/N) ? >**

The file name *may* include drive and path specifications if it is desired to store the file in other than the disk or current directory.

Once recording starts, you will see the file name on the right end of the top line of the PC-AMTOR screen. It will remain there until you exercise the **Stop Save** command.

The *maximum* file length for **Continuous Save** mode is 20,000 characters. When this limit is reached, the file is automatically closed and you must then initiate a new Save To Disk operation. A 20,000 character file represents approximately 55 minutes of 60 WPM Baudot, 50 minutes of AMTOR, or 33 minutes of 100 WPM Baudot (or 110 baud ASCII). If you need a longer text recording period, use the **Sequential** disk save option.

NOTE: PC-AMTOR echoes all transmitted text to the receive buffer. Therefore a recording of "received text" will also include a copy of what you may have transmitted.

3.8.2.2 Save To Disk Sequential

The second way to record received text will result in creation of a sequence of similarly named disk files. This option works in the same way as the **Continuous Save** mode except for the following:

1. You can specify only the "name" of the file and not the "extension".

2. PC-AMTOR automatically adds a sequential number as the "extension".

3. Reception of NNNN automatically causes one file to be closed and a new file to be opened using the next sequence number as the extension.

4. If the 20,000 maximum character limit is exceeded, the current file is closed and a new file using the next number extension is opened.

5. Text is not lost between closing one file and opening the next.

The procedure to make a **Sequential** disk recording is the same as that given for a **Continuous** recording *except* that you specify only the file name (8 characters maximum) and not the "extension". The procedure is:

1. Press [F1] to enter COMMAND mode
2. Type F to get the **Files** menu
3. Type [Down-arrow] once to get **Save To Disk**
4. Type [Enter]
5. Type [Down-arrow] once to get **Save To Disk Sequential**
6. Type [Enter]
7. Enter a file name (no extension)
8. Use the [arrow] keys to highlight the desired "start" line.
9. Type [Enter]

OR

8a. Type [Enter] with no "start" specification to continue recording

To STOP recording:

1. Press [F1] to enter COMMAND mode
2. Type F to get the **Files** menus
3. Type [Down-arrow] twice to get **Stop Save**
4. Type [Enter]
5. Type Y in response to **Stop Store To Disk (Y/N) ? >**

Once recording starts, you will see the file name on the right end of the top line of the PC-AMTOR screen. It will remain there until you exercise the **Stop Save** command.

The file name may include drive and path specifiers if it is desired to store the file in other than the disk or current directory.

Note that, by specifying the start line number in the receive buffer, you may use this feature to record text that has already been received and include it in an on-going recording. If the previously received text includes the NNNN letter sequence, the automatic file creation feature will make new disk files for each text segment between the NNNN characters.

As noted above, the 20,000 maximum characters per file limit still applies, but if this limit is reached in **Sequential** mode, PC-AMTOR automatically opens a new file and keeps recording.

The file names created using the **Sequential** mode will all have the same "root" name and differ only by the number used as the "extension". For example, if the "root name" **20DEC89** is specified in step 5, the series of files might be named:

20DEC89.001
20DEC89.002
20DEC89.003
20DEC89.004
etc.

This file name organization makes it very easy to copy, edit, send, or delete a related series of messages. The **Save To Disk Sequential** option is very useful when processing multiple messages in a "traffic system". The *sender* should, however, understand and follow the standard convention of ending each message with NNNN.

3.8.2.3 Save NAVTEX Files

NAVTEX mode is discussed in Section D.5 of the OPERATOR'S GUIDE. NAVTEX is a FEC receive-only mode for marine weather information. Each weather message carries a unique message title (2 characters) and serial number (2 digits). Each message ends with the special "NNNN" character sequence. When the NAVTEXfile storage option is selected, NAVTEX messages are stored to disk using a file name made up of the four character message ID and ".NAV" as the file extension. Only the *most recent* reception of a given message is stored. Each repeat of a message will over-write a previously stored version of that message. PC-AMTOR does NOT do an error-assessment or comparison between repeat copies of the same message. Use the following procedure to save NAVTEX messages:

1. Press [F1] to enter COMMAND mode
2. Type F to get the **Files** menu
3. Type [Down-arrow] twice to get **Save NAVTEX File**
4. Type [Enter]

To STOP NAVTEX recording:

1. Press [F1] to enter COMMAND mode
2. Type F to get the **Files** menu
3. Type [Down-arrow] twice to get **Stop Save**
4. Type [Enter]
5. Type Y in response to **Stop Store To Disk (Y/N) ? >**

3.8.2.4 Receive Buffer Block Save

This file save mode allows you to pick a specified range of text from the *receive* buffer and save it to disk. Text selection is *by line* in the receive buffer. The procedure to use is:

1. Press [F1] to enter COMMAND mode
2. Type F to get the **Files** menu
3. Type [Down-arrow] once to get **Save To Disk**
4. Type [Enter]
5. Type [Down-arrow] three times to get **Receive Buffer Block Save**
6. Type [Enter]
7. Enter a file name
8. Use the [Up-arrow] key to highlight the desired "start" line.
9. Type [Enter]
10. Use the [Down-arrow] key to highlight the desired save block
11. Type [Enter]

Since both "start" and "end" points are specified (steps 8 and 10), the marked text is saved to the disk and no "Stop" command is required.

3.8.2.5 Transmit Buffer Block Save

This file save mode allows you to pick a specified range of text from the *transmit* buffer and save it to disk. Text selection is *by line* in the transmit buffer. The procedure to use is:

1. Press [F1] to enter COMMAND mode
2. Type F to get the **Files** menu
3. Type [Down-arrow] once to get **Save To Disk**
4. Type [Enter]
5. Type [Up-arrow] once to get **Transmit Buffer Block Save**
6. Type [Enter]
7. Enter a file name
8. Use the [Up-arrow] key to highlight the desired "start" line.
9. Type [Enter]
10. Use the [Down-arrow] key to highlight the desired save block
11. Type [Enter]

Since both "start" and "end" points are specified (steps 8 and 10), the marked text is saved to the disk and no "Stop" command is required.

3.8.3 Disk Directory

The fourth option in the **Files** menu allows viewing of the disk directory in a shortened format. This is a convenient feature to use to be sure that you are not duplicating file names when saving to disk and to recall file names when transmitting.

Upon choosing **Directory**, you are first given a chance to specify disk and path specifications. If you type [Enter] at this point, you will be shown the directory of the drive and sub-directory used for PCA.EXE. If a large number of files are in this directory, you may continue typing [Enter] to "scroll-through" the complete directory list. Type [Esc] to return to the **Files** menu and select a file save or transmit option. You may also view the directory of any other disk drive and/or sub-directory. For example, you can view the directory of drive B: or sub-directory C:\TEXT using this option.

NOTE: Even though the Directory menu option allows viewing of any directory, the default file storage and retrieval directory remains that in which PCA.EXE is located. To send or save a file in any other directory, you must specify the full "path" when entering the file name for these options (example: C:\RTTY\MARS\TEST.001). Viewing other directories does not change the "logged" directory of PC-AMTOR.

3.8.4 RTTY Picture Files

Pictures sent via RTTY often use special End-Of-Line (EOL) sequences so that a hard-copy printer over-prints one or more lines for additional emphasis and contrast. Such files may be received and stored by using **Save To Disk - Continuous** mode. The text is stored on the disk *exactly* as received with no additional (or fewer) end-of-line characters. These files may also be transmitted by using the **Send From Disk** option. In this case, the disk file is sent *exactly* as stored, including only the end-of-line characters contained in the disk file. **Do not** use **Load TX Buffer** to send RTTY picture files as this option uses end-of-line characters set in the **Configuration** menu.

3.9 Transmit Buffer Editor

PC-AMTOR includes a text editor that may be used with any text contained in the transmit buffer area. This editor has many features and should generally be satisfactory for most radio communications purposes. However, it is not intended for general word processing use and some special word processing features are not available - such as block manipulation, right justification, and special print controls. HAL suggests that you obtain a good word processing program for these advanced features.

Special keys associated with the transmit buffer are shown in Table 3.8.

TABLE 3.8
TRANSMIT BUFFER CONTROL KEYS

KEY	OPERATION
[Alt]-X	Set scroll key to control the transmit buffer
[left arrow]	Move cursor left one character.
[Ctrl]-[left]	Move cursor left one word.
[right arrow]	Move cursor right one character
[Ctrl]-[right]	Move cursor right one word
[up arrow]	Move cursor up one line
[down arrow]	Move cursor down one line
[PgUp]	Move cursor up ten lines (one screen)
[PgDn]	Move cursor down ten lines (one screen)
[Home]	Move cursor to beginning of line
[Ctrl]-[Home]	Move cursor to line 1, column 1
[End]	Move cursor to end of line
[Ctrl]-[End]	Move cursor to last text line of transmit buffer
BS ([Ctrl]-H)	Delete character to left of cursor
[Back arrow]	Delete character to left of cursor
[Del]	Delete character at cursor
[Ins]	Toggle between INSERT and OVERTYPE modes
[Alt]-F	Reformat current paragraph
[Alt]-K	Delete line
[Alt]-W	Delete word
[Alt]-V	Clear Entire Transmit buffer

BE CAREFUL ABOUT [Alt]-V! It clears the entire 250 line transmit buffer. Once deleted, text is not recoverable!

The transmit buffer editor is always available and you may move the cursor into pre-typed text, fix typing errors and add or delete sections, even while transmitting. One caution is, however, noteworthy:

PC-AMTOR transmits up to the keyboard cursor position.

If you have pre-typed some text, start transmitting, and then move the cursor up into the pre-typed text to edit, transmitting will continue *until the transmitted output "catches-up" with the keyboard cursor.* When this happens, transmit text output ceases. If you are using RTTY or CW, the automatic transmit/receive control will then put your station back in receive mode and

not send any text that follows the keyboard cursor. In AMTOR ARQ mode, the transmitter will continue "chirping", but sending "IDLE" characters. It can be *very* confusing if you accidentally type [Ctrl]-[Home] and leave the keyboard cursor at the line one column one position. In this case, you will send no characters, even if you happen to have a lot of pre-typed text.

Be sure to return the keyboard cursor to the end of pre-typed text after editing!

The transmit buffer editor may be used to "clean-up" disk files and store them back to disk *without* transmitting. To do this, follow the procedure in Section 3.8.1 to load a disk file into the transmit buffer. Be sure that you have set the transmit buffer output to "DIS" (Disabled) using [Alt]-[F10]. Now, edit the text in the file and save it back to disk using the procedures given in Section 3.8.2.3.

Editing may be done in either "INSERT" or "OVERTYPE" mode. PC-AMTOR always starts in "INSERT" mode, but you may change to "OVERTYPE" by typing the [Ins] key once. This key is a "toggle" key and a second press of [Ins] will return you to "INSERT" edit mode. OVERTYPE mode is indicated by the letters **OVR** in the bottom help line.

The [Alt]-F key is unique. It allows you to re-format a paragraph in which you may have deleted or added text. To use it, complete your editing in the paragraph, move the cursor to the first character in the paragraph, and type [Alt]-F. The editor will re-arrange the word positions so that each line is filled. PC-AMTOR's HAL "definition" of a "paragraph" is the text included between blank lines.

The above paragraph starts with "The [Alt]-F ... and ends at "... lines."

NOTE: [Alt]-F does not provide right-justification.

If right-justification is desired, HAL suggests that you use a full word processing program.

This completes the discussion of special operation modes of PC-AMTOR. Please also read the companion OPERATOR'S GUIDE as it contains many more operation details.

CHAPTER 4
USING HOST MODE

This Chapter is devoted to using the PCI-3000 "Host Port" and "Host Mode" of control. Both hardware interfacing and host mode commands will be discussed.

4.1 Host Mode vs PC-AMTOR Software

Host Mode is a unique feature of the PCI-3000. It provides an *alternate* control port to the PCI-3000 circuit board hardware. Host mode is provided specifically to allow PCI-3000 control by user-supplied software that uses a PC serial I/O port for connection to an AMTOR/RTTY/CW device. Such programs might be APLink or "mailbox" programs (sometimes called "BBS" or "MSO" programs).

IMPORTANT:

You do not use the PC-AMTOR software package when using the Host Port.

The instructions in the OPERATOR'S GUIDE and Chapter 3 of this manual DO NOT APPLY TO HOST MODE!

PC-AMTOR and Host Mode are two different software means of controlling the PCI-3000 hardware. You may use one or the other, but not both at once.

Host Mode has its own *different* command set and wire connections to a serial I/O port of the PC. The command set is greatly simplified and specifically designed for easy interface to APLink.

4.2 Host Port Connections

The PCI-3000 Host Port is a standard **DCE**-type RS-232 serial I/O connection to the PCI-3000 circuit board. It uses selected pins of the PCI-3000 rear panel 25-pin connector as shown in Table 2.1.

NOTE:

Due to the large number of I/O signals used in the PCI-3000, Host Port connections to the PCI-3000 rear panel connector are not located on "standard" RS-232 pin numbers. Do not connect a 25-wire "RS-232" patch cable directly between the PCI-3000 rear panel connector and a PC serial I/O connector. However, the SPT-2 accessory includes a special Host Port connector that does have standard RS-232 pin connections.

As noted in Section 2.5, I/O connections may be made either directly to the PCI-3000 rear panel connector or through the SPT-2 SPECTRA-TUNE accessory. However, installation is *much* simpler if the SPT-2 is also installed. Both connection techniques will be discussed.

4.2.1 Direct Host Port Connection to PCI-3000 Rear Panel

The pin connections and signal data for direct Host Port connection are shown below in Table 4.1. Radio connections are not shown since they have already been discussed in Section 2.5.1.

TABLE 4.1
PCI-3000 HOST PORT CONNECTIONS

PIN	NAME	FUNCTION	I/O	LIMITS	NOTE
2	TXD	Host Port RS-232 Data Input	Input	±12 VDC	
3	RTS	Host Port RS-232 Request-To-Send	Input	±12 VDC	
4	SEL-CAL	SEL-CAL output	Output	+50V, 100ma	
5	DCD	Host Port RS-232 Carrier Detect	Output	±12 VDC	
10	GND	Signal Ground	(Gnd)		1
12	GND	Signal Ground	(Gnd)		1
15	DTR	Host Port RS-232 Data Terminal Ready	Input	±12 VDC	
16	RXD	Host Port RS-232 Data Output	Output	±12 VDC	
17	CTS	Host Port RS-232 Clear-To-Send	Output	±12 VDC	
20	DSR	Host Port RS-232 Data Set Ready	Output	±12 VDC	
25	GND	Signal Ground	(Gnd)		1

NOTES:

1. Host Port may use any of the three ground connections (pins 10, 12, or 25). Be sure to leave adequate ground connections to the radio.

2. PC power supply voltages are on pins 21, 22, and 23 to power the SPT-2. Be very careful to avoid shorting any of these pins.

A suggested cable for connection between the PCI-3000 and a PC serial I/O port is shown in Figure 4.1. Note that this diagram does not show radio connections which are also required. Please refer to Section 2.5.1 for radio connection details.

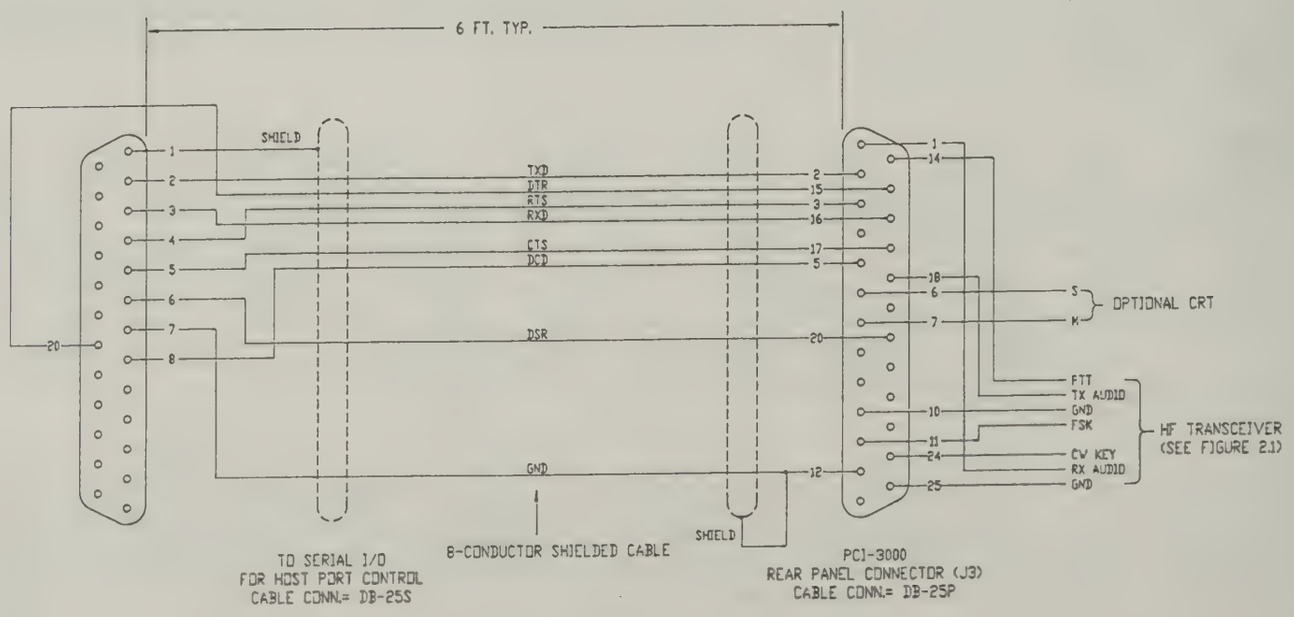

Figure 4.1 Direct Host Port Cable Connections

4.2.2 Host Port Connection Using the SPT-2

As noted in Section 2.5.2, the SPT-2 serves two purposes when connected to the PCI-3000: (1) AMTOR/RTTY/CW tuning indicator, and (2) "fan-out" of radio *and* Host Port connections. The SPT-2 includes a standard DB-25S Host Port connector whose pins DO conform to RS-232 connection standards.

> *The SPT-2 Host Port connector may be directly patched to a PC serial I/O port using standard 25-wire DB-25 patch cables.*

The SPT-2 Host Port pin connections are shown in Table 4.2. A typical RS-232 patch cable is shown in Figure 4.2.

TABLE 4.2
SPT-2 HOST PORT CONNECTIONS

PIN	NAME	FUNCTION	I/O	LIMITS	NOTE
1	GND	Chassis Ground	(Gnd)		2
2	TXD	Host Port RS-232 Data Input	Input	±12 VDC	
3	RXD	Host Port RS-232 Data Output	Output	±12 VDC	
4	RTS	Host Port RS-232 Request-To-Send	Input	±12 VDC	
5	CTS	Host Port RS-232 Clear-To-Send	Output	±12 VDC	
6	DSR	Host Port RS-232 Data Set Ready	Output	+12 VDC	
7	GND	Signal Ground	(Gnd)		2
8	DCD	Host Port RS-232 Carrier Detect	Output	±12 VDC	
20	DTR	Host Port RS-232 Data Terminal Ready	Input	±12 VDC	

NOTES:
1. All other DB-25 pins are no connection.
2. Connect Signal ground to pin 7 and cable shield to pin 1
3. The Host Port DB-25S is a DCE device.

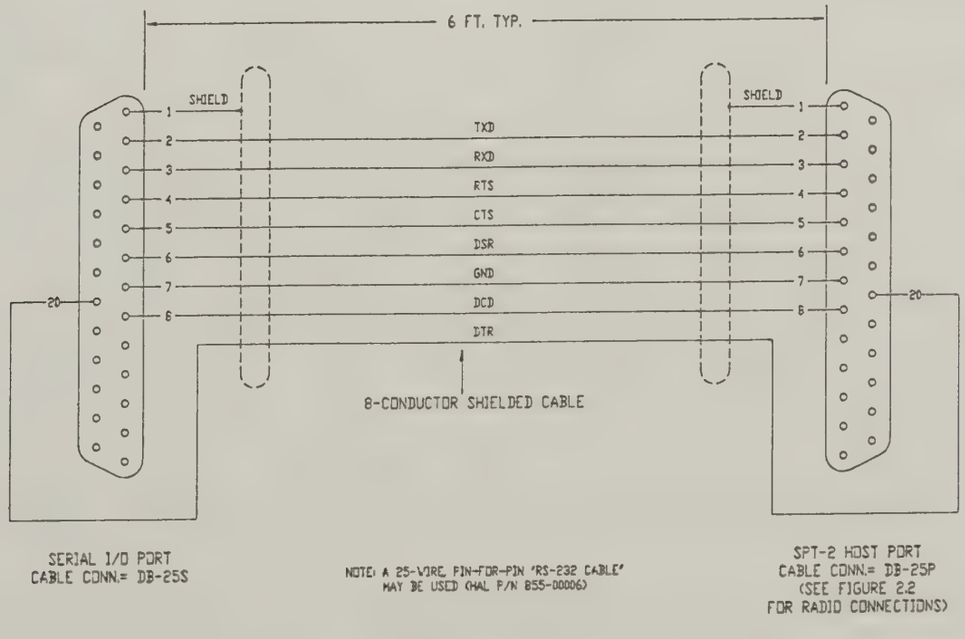

Figure 4.2 SPT-2 Host Port Cable

4.2.3 PC Serial I/O Port Settings

When using the PCI-3000 Host Port, the PC serial I/O port should be set-up for the following conditions:

RS-232 Data
DTE (Data Terminal Equipment)
Code = ASCII (1 start bit, 8 data bits, 1 or 2 stop bits)
Rate = 110 Baud
FDX (Full Duplex)
Support RTS and CTS control signals

These conditions are met by the "AMT-1 Version" of APLink and may be set by most good PC terminal software programs.

Bit 7 (highest bit) is set to "0" (low) for all conditions except when the "Status Character" is sent from the PCI-3000 to the PC serial port. If your PC terminal program requires use of the "Status Character", it must be able to read 8, rather than 7 data bits. There is no condition in which 8 data bits must be sent to the PCI-3000. See Section 4.3 for more details.

4.2.4 Other Active Connections in Host Mode

Use of Host Mode does not preclude use of any of the other radio or control hardware signals available on the PCI-3000 rear panel connector or through the SPT-2. Radio connections as described in Section 2.5 are of course essential for operation of the PCI-3000.

All features of the SPT-2, including tuning indication, mode switching and panel LED indications operate in Host Mode and are still controlled by the PCI-3000. The Mark and Space RTTY CRT outputs are still usable and the AMTOR SEL-CAL output may also be used. A special SEL-CAL mode switch command is included in the Host Mode command set.

4.2.5 Hardware Flow Control

The Host Port on the PCI-3000 uses hardware flow control signals **CTS** and **RTS** to regulate the flow of text data into and out of the Host Port. Flow control prevents loss of text during operation by signaling when internal buffers are nearly full. RTS and CTS operation matches that of the AMT-1 to assure software compatibility with APLink and other software using AMT-1 commands.

During text transmission in any mode, the PCI-3000 **CTS** signal will turn OFF (negative voltage) when the internal character buffer comes close to filling completely. The terminal or PC application program should test the CTS signal and stop data to the PCI-3000 Data Input when CTS turns OFF. CTS is also OFF in modes where the PCI-3000 will not accept text, such as ARQ-LISTEN, FEC receive, ARQ standby, and during an ARQ call. Note that even when CTS is OFF, Host Port commands are processed by the PCI-3000. Thus the PC application program or attached terminal should transmit these commands, *even when CTS is OFF.*

The **RTS** control signal stops the transmission of received text out of the Host Port whenever RTS is OFF (negative voltage). *If no output flow control is required, RTS should be held ON (positive voltage) or disconnected altogether.*

4.3 Host Mode Commands

The PCI-3000 Host Port uses a command set that is very similar to that used in the AMT-1 AMTOR Terminal Unit^{tm}. This command set is very simple and has been expressly chosen to assure compatibility with existing APLink software. Several additional commands have been included to expand the versatility of Host Mode, but any software designed to control the AMT-1 should also be usable with the PCI-3000. The Host Mode Commands that match the AMT-1 are listed in Table 4.3. Explanation of the Terminal Status Command ([Esc]-Q) is given in Table 4.4; the Status Command ([Ctrl]-E) in Table 4.5.

All Host Mode commands are accessed by typing the [Esc] key or by using the [Ctrl] key in addition to a letter key. All commands may be entered at any time. Each command is automatically terminated when the correct number of keystrokes have been entered.

Most commands will cause interruption or a change in text handling as modes are changed. However, the "Status Character" command ([Ctrl]-E) may be entered at any time and an immediate response will be sent to the PC serial I/O port. The Status Character is bit-oriented as shown in Table 4.5. Only the Status Character is sent to the PC with bit 7 (highest order bit) set to "1" (high). Bit 7 is set to "0" (low) for all other characters sent to the PC. This feature may be used to trap and suppress printing of Status Character responses.

The AMT-1 provides Baudot RTTY data rate setting in 1 baud increments from 01 to 100 baud. The PCI-3000 only supports the standard data rates of 45, 50, 57, 75, and 110 baud. Recognizing that some programs may expect to see what they entered echoed back, Host Port will echo the same two-digit rate number back to the controlling terminal. HOWEVER, the PCI-3000 then "averages" the two-digit rate number to fit its available RTTY rates as follows:

01 to 47	45 baud
48 to 53	50 baud
54 to 66	57 baud
67 to 92	74 baud
93 to 99	110 baud
00	110 baud

The AMT-1 supports ASCII RTTY only by passing-through terminal data at 110 baud to its internal modem using the [Esc]-D command. The AMT-1 cannot support any other data rates and the ASCII RTTY mode in the AMT-1 requires "power OFF" to change back to Baudot, AMTOR, or CW. The PCI-3000 interprets [Esc]-D as "set ASCII RTTY mode" and uses the data rate set by [Esc]-B. Thus, all RTTY speeds are available for both Baudot and ASCII. You do not have to turn power OFF of the PCI-3000 to exit ASCII mode! As in the AMT-1, [Esc]-R selects the Baudot RTTY code.

NOTE: The AMT-1 Command Set uses the [Esc] and many [Ctrl]- characters. Therefore these characters cannot be transmitted using Host Mode.

The AMT-1 includes only CW transmit - not CW receive. In the PCI-3000, [Esc]-C sets CW send *and receive* mode.

TABLE 4.3
HOST MODE COMMANDS

HOST MODE COMMAND		DESCRIPTION
[Esc]-A		Enter AMTOR Standby mode
[Esc]-B		Set RTTY Baud Rate: 45, 50, 57, 75, or "00" for 110 2nd digit ends entry
[Esc]-C		Enter CW mode
[Esc]-D	1	Enter ASCII mode, Baud = 110
[Esc]-I		Set own SEL-CAL (4 letters); 4th char. ends entry.
[Esc]-L		Echo switch: [ESC]-L 0 to disable.
[Esc]-N		Auto newline control: [Esc]-N 1 Enables, 0 disables
[Esc]-P	2	Set SEL-CALL output mode (0 = continuous, 1 = pulsed)
[Esc]-Q		Output terminal values (see Table 4.4)
[Esc]-R		Select RTTY (Baudot) mode
[Esc]-S		Set CW speed in WPM; 05 - 50 = WPM speed
[Esc]-T		Set time-out during phasing: 01 = OFF; 00 & 02-99 = ON
[Esc]-U	2	Set CD (Control Delay; 2 digits; 05 - 99; greater than TD)
[Esc]-V	2	Set TD (Transmit Delay; 2 digits; 05 - 99; less than CD)
[Crtl]-A		RTTY: go to transmit AMTOR: specify 4-letter outgoing SEL-CAL and xmit in ARQ mode. CW: go to transmit
[Ctrl]-B		RTTY: go to transmit AMTOR: start FEC transmission. CW: go to transmit
[Ctrl]-C		RTTY: switch from TX to RX AMTOR: ARQ "Over" FEC - no effect CW: go to receive
[Crtl]-D		RTTY: switch from TX to RX AMTOR: FEC - send end code ARQ - send end but only when ISS. LISTEN: end listen mode, go to STBY CW: go to receive
[Ctrl]-E		Send status character to terminal (see Table 4.5)
[Ctrl]-F		RTTY: no effect AMTOR: enable LISTEN mode; must be in AMTOR mode first ([Esc]-A)
[Ctrl]-G		RTTY & AMTOR: send bell CW: no effect
[Ctrl]-S	2	Enter ESCape mode (for manual control within APLink)
[Ctrl]-X		Clear transmit buffer; will also clear any pending CTRL-D.
[Del]		RTTY & AMTOR: force receive LTRS shift CW: no effect
[CR], [LF], [Null]		Treated as text and passed to xmtr; next non-[Ctrl] char. will include FIGS or LTRS as indicated.

NOTES:

1 = ASCII mode cannot transmit [Esc] or any control characters used in the above command set.

2 = New commands, additional to those of the AMT-1

TABLE 4.4
[Esc]-Q Terminal Value Response Example

Example Return: "V:01 I:???? T:30 B:45 S:20 L:1 N:1"
V.01 = firmware version number

I:[own SEL-CAL]	S:20 = CW Speed (20 wpm)
T:30 = Timeout (30 sec)	L:1 = Echo ON (0 = OFF)
B:45 = Baud Rate (45 bd)	N:1 = Auto New Line ON

TABLE 4.5
[Ctrl]-E Status Character Bit Construction

Bit Number								
7	6	5	4	3	2	1	0	Status Condition
1	.	.	.	.	0	0	0	Error
1	.	.	.	.	0	0	1	RQ
1	.	.	.	.	0	1	0	Traffic
1	.	.	.	.	0	1	1	Idle
1	.	.	.	.	1	0	0	Over
1	.	.	.	.	1	0	1	Phase
1	.	.	.	.	1	1	0	STBY
1	.	.	.	.	1	1	1	ESC
1	.	.	.	0	.	.	.	Not SEND
1	.	.	.	1	.	.	.	SEND
1	.	0	0	.	.	.	.	ARQ Mode
1	.	0	1	.	.	.	.	FEC Mode
1	.	1	0	.	.	.	.	RTTY Mode
1	.	1	1	.	.	.	.	CW Mode
1	0	.	.	.	.	.	.	Buffer Empty
1	1	.	.	.	.	.	.	Buffer Not Empty

These are the commands and features available in the Host Mode of the PCI-3000. HAL suggests that this mode be used for APLink and mailbox software compatible with the above commands. You may also use this port to write your own AMTOR and RTTY PC software, but using PC-AMTOR will save a lot of programming effort and probably be much more convenient.

NOTE: It is necessary to either use an AMT-1 compatible program or write your own program that uses the above commands to use the Host Port of the PCI-3000.

CHAPTER 5
TECHNICAL DESCRIPTION

The PCI-3000 circuit is contained on one plug-in printed-circuit card. This card may be installed in any personal computer that is "compatible" with the IBM* PC-XT, PC-AT, or PC-286 computers. A "full-length" expansion slot is required for the PC-AMTOR circuit board. All power for PC-AMTOR circuitry is obtained from the personal computer. All I/O connections to radio equipment and to the "host port" are made to one 25-pin connector (DB-25S) on the PCI-3000 rear panel. The SPT-2 SPECTRA-TUNE accessory provides phono-connector expansion of the various radio connections.

A block diagram of the PCI-3000 circuit board is shown in Figure 5.1. The circuit has four major sections: (1) Digital control and interface circuits, (2) Receive demodulator circuits, (3) Transmit modulator and keying circuits, and (4) I/O Connections. These sections will be discussed in that order.

5.1 PCI-3000 Digital Circuitry

PC-AMTOR uses a novel dual-processor approach to code and decode AMTOR, RTTY, and CW. The PCI-3000 circuit board includes its own Z-80 8-bit microprocessor. This processor and its associated RAM and ROM do all data coding and decoding. Only ASCII characters are passed via the PC bus to the personal computer microprocessor. The PC-AMTOR program then provides screen display and access to the various features, modes, and programmable messages. This greatly relieves the PC processor of time consuming tasks, making it more available to handle screen displays, keyboard input, and multi-tasking PC applications.

5.1.1 Microprocessor, RAM, ROM (Figure 5.2)

The PCI-3000 uses an industry standard Z-80A microprocessor, U11, running at 4 MHz with 32K bytes of EPROM and 8K bytes of RAM. The Z-80A is contained in a modern Plastic Leadless Chip Carrier (PLCC) package to reduce the circuit board space required by the microprocessor. U7 is an industry standard 32K byte EPROM that contains all of the on-board "firmware" needed to run the Z-80A. U6 is an industry standard 8K or 32K byte RAM.

The Z-80 microprocessor and its software do all data coding and encoding. AMTOR and RTTY use a "software UART" routine that gives considerably better recovery of noisy HF radio data than is possible using standard hardware UART IC's. Z-80 software also controls receive and transmit data polarity.

All of the peripheral devices and registers are I/O mapped in the PCI-3000. U21 is an address decoder that is only active when the Z-80A has issued an I/O input or output request.

Unlike other interface boards, the PCI-3000 includes a DS-1232 "Sanity Timer", U27, to monitor the Z-80A status. During normal operation, the Z-80A periodically pulses the DS-1232 SANITY input to reset an internal timer. Should a transient cause improper Z-80A operation, the periodic pulses stop and the DS-1232 will reset the Z-80A. In addition, the DS-1232 insures a proper power-on reset by holding the Z-80A in a reset condition until about 250 ms after the +5 VDC supply is stable.

5.1.2 PC Data Bus Interface (Figures 5.3 and 5.4)

Circuits U8, U9, U22, U23, U24, U25, U26, U28, U29, and U30 make up the interface between the on-board Z-80 microprocessor and the personal computer expansion card bus. A 8-bit wide interface is used for this bus connection.

The PCI-3000 is unique among PC expansion circuit boards in that it does not require use of any standard PC I/O addresses or interrupts. Installing the PCI-3000 will not interfere with the operation of any standard PC I/O board such as serial I/O, parallel printer, disk drive, clock, etc. Rather, the PCI-3000 may be set to a range of "unassigned" PC I/O addresses. These addresses are set with DIP switch SW1. Refer to Chapter 2 for adjustment procedures for SW1. PC-based software (PCA.EXE) provided with the PCI-3000 (floppy diskette) will automatically sense which I/O address has been selected by SW1 and adjusts the PC-based program to poll this address. Therefore, even if another PC circuit board using this address scheme is installed in the personal computer, the PCI-3000 "location" may be set to prevent a conflict and the HAL software will adjust for the change. In general, the factory-set default will be correct for most personal computer systems.

The PCI-3000 uses an 8 bit latch, U26, for data coming from the PC. When a valid PC I/O address is detected by comparators U28 and U29, the address decoder U22 is enabled. The PC loads the 8 bit data latch and sets a data ready bit by issuing an output write to the proper I/O address. When the Z-80A reads this data byte, the ready status bit is cleared. The PC reads a status bit to know when the next data byte may be loaded.

A second 8 bit latch, U25, passes data from the PCI-3000 to the PC bus. A status bit is set when the Z-80A loads this register and the PC polls this status bit testing for the ready bit. When the PC reads the data byte by issuing an input read, the data ready bit is cleared.

The PC is able to force a PCI-3000 reset by issuing an output write to U23, the PC reset latch.

Note that all data signals on the PC bus interface are buffered by U30. Unlike other interface cards, the PCI-3000 presents only a single LS-TTL load on all PC bus data and address signal lines.

5.1.3 Programmable Timers (Figure 5.5)

PCI-3000 internal timing is generated by a 16 bit timer in the 8530 Serial Communications Controller (SCC), U12. The output of this timer is connected to the Non-Maskable Interrupt (NMI) input on the Z-80A to provide a stable time reference. The timer rate varies with the current PC-AMTOR mode since it controls the transmit and receive timing for all CW and AMTOR/RTTY modes.

5.1.4 "Host Port" Interface (Figure 5.5)

A separate serial I/O control port is also provided on the PCI-3000 so that complete control of the coding and decoding functions may be done independently of the personal computer bus system. This is particularly useful when it is desired to use special communications control software that requires use of a PC serial I/O port - programs such as APLink and radio "mailbox" ("BBS") programs.

Stage U12 also serves as the serial I/O UART for the "host port" serial I/O control port of the PCI-3000. Stages U10 and U13 provide TTL-to-RS232 data level conversion for the "host port" connections. Standard RS-232 signals RXD, TXD, CTS, RTS, DSR, DTR, and DCD are supported on the "host port".

5.1.5 Other Control Signals (Figure 5.5)

The 8 bit latch U5 controls a number of operations in the PCI-3000. Since a software UART is implemented in the Z-80A firmware, one bit of this latch directly controls the TXD output. Other bits control the PTT and SELCAL outputs. One bit turns the AFSK tone generator ON and OFF. Two data bits set the print squelch level, which will be discussed in a subsequent section.

5.1.6 SPT-2 Special Outputs (Figure 5.5)

Two special signal outputs are provided for use by the SPT-2 Spectra-Tune accessory. The first, "CW/RTTY" (J3, pin 8) signals the SPT-2 to change its tuning indicator scale center frequency from 800 Hz (CW) to 2210 Hz (AMTOR/RTTY). The SPT-2 therefore requires no front panel scale switch or calibration adjustment (unlike the previous SPT-1 which has no automatic scale adjustment feature). The second signal is "CWLED" (J3, pin 19), an output that is used to drive a CW LED on the front panel of the SPT-2. This lamp is ON whenever a key-down condition is detected. Both the SPT-2 frequency display and the CW LED assist when tuning a CW signal for reception. If the SPT-2 accessory is not used, the CW LED feature may still be used by connecting a standard LED between pin 19 of J3 and ground (anode to pin 19, cathode to ground).

5.2 Receive Demodulator Circuits.

5.2.1 Input Limiter and AGC (Figure 5.6)

Receive audio output from pin 1 of J3 (AFIN) drives both an AMTOR/RTTY limiter stage (U4a) and a CW Receive AGC circuit (U4b).

The limiter uses an MC34002 wide-bandwidth FET-input operational amplifier IC to assure a low limiter input threshold over the pass-band of the RTTY tones (2100 to 2300 Hz). Signals with an amplitude greater than -40 dBm (approximately 8 mV rms) are limited and passed to the Mark and Space channel filters (U3a and U3b). Signals in the range of -40 to +10 dBm are limited by U4a. Control R59 adjusts the limiter balance. Consult Chapter 6 for adjustment procedures.

The CW AGC amplifier dynamically compensates for variations in receiver output level over a range from -35 dBm to +10 dBm. The input signal is amplified by U4b and peak detected by D6 and D7. The detected voltage drives attenuator amplifier Q1. The effective shunt-to-ground impedance of Q1 and input resistor R38 form an L-pad, attenuating the signal input to U4b. The "regulated" output signal at U4, pin 7 is approximately 0 dBm. This signal then drives the CW filter (U1a, Figure 5.8).

5.2.2 AMTOR/RTTY Mark and Space Filters (Figure 5.6)

Stage U3a is a two-pole bandpass filter with center frequency set to 2125 Hz, the Mark frequency (1275 Hz on export versions). Center frequency is adjusted by control R31. See Chapter 6 for the adjustment procedure. Resistor R32 sets the Q of the filter and therefore its bandwidth (Q=18.5, a BW of 115 Hz). The Mark filter has a gain of approximately 6 dB.

Stage U3b is a two-pole bandpass filter with center frequency set to 2295 Hz, the Space frequency (1445 Hz on export versions). Center frequency is adjusted by control R31. See Chapter 6 for the adjustment procedure. Resistor R27 sets the Q of the filter and therefore its bandwidth (Q=20, a BW of 115 Hz). The Space filter has a gain of approximately 6 dB.

5.2.3 AMTOR/RTTY Detector, LP Filter, Slicer (Figure 5.7)

The outputs of the Mark filter (U3-8) and Space filter (U3-7) drive the Mark and Space active detector circuits (U2c and U2d). Detector stage U2c is an ideal diode detector that produces a positive DC voltage output for Mark data signals. Stage U2d detects the Space data signal, but with a negative DC voltage output.

The two detector outputs are summed through resistors R16 and R17 to the input of the Low Pass post-detection filter stage, U2a. The combination of R26/R17 and C3 with stage U2a provides a three-pole linear-phase low-pass filter with cutoff at 75 Hz. Control R20 allows precise adjustment of the Mark/Space balance of the detector output. See Chapter 6 for adjustment of this control.

The filtered data output at U2-1 is then squared in slicer stage U2b and converted to TTL logic levels by the R14, D1, and D12 network. The resulting AMTOR/RTTY receive data signal then drives an input to the Z-80 microprocessor. Data decoding and polarity adjustment is done by the Z-80.

5.2.4 CW Filter and Detector (Figure 5.8)

The AGC-controlled receive signal from U4-7 (Figure 5.7) drives the CW input filter stage, U1a. The CW filter is a 2-pole bandpass filter with center frequency set to 800 Hz via control R8. See Chapter 6 for adjustment of this control. The Q of the CW filter is set to 8.0, a bandwidth of 100 Hz. This filter has a gain of approximately 6 dB.

The output of the CW filter is adjusted in amplitude by resistor divider R6 and R7. The level is set such that valid signals at 800 Hz produce sufficient amplitude to trigger the Phase Locked Loop (PLL) CW detector, U14. Signals with a frequency different from 800 Hz do not produce sufficient amplitude to trigger the PLL.

The CW detector uses an MC1310 PLL IC to detect the presence (or absence) of an 800 Hz CW signal tone. The center frequency of the PLL Voltage Controlled Oscillator (VCO) is set by control R78. See Chapter 6 for adjustment of this control. The detected CW output at TP2 has TTL-levels and is <u>low</u> for key-down state. This data drives an input to the Z-80 microprocessor. CW decoding is done by Z-80 software.

5.2.5 RTTY Autoprint Control (Figure 5.9)

The Mark and Space filter outputs (U3-8 and U3-7, Figure 5.7) are also detected and filtered by D18, D19, and Q7. However, unlike the Mark and Space data detectors, both Mark and Space signals are detected for a <u>positive</u> DC output voltage at the emitter of Q7. This "plus-plus" signal is peak detected and integrated by D17, C36, and R54 and drives the positive input of threshold detector stage U16a. When a correctly tuned FSK signal is detected, the "plus-plus" voltage remains at a steady positive DC voltage. If only one tone (Mark or Space) or no tone matches the Mark and Space filter frequencies, R54 discharges C36 and the DC voltage at U16-3 has a lower value.

The negative input of U16a is a DC voltage set by the digital potentiometer IC, U17. U17 is a 10k ohm potentiometer whose wiper position is digitally set under Z-80 control. Whenever the "plus-plus" voltage at U16-3 exceeds the voltage at U16-2, the output (U16-1) is positive and text is forwarded to the PC for screen display. If the "plus-plus" voltage is lower than that from U17, the signal test fails and no text is printed.

The output of the autoprint detector is converted to TTL levels and drives an input to the Z-80 microprocessor (PRINT). The actual decision about print or no-print is made by software in the Z-80 and in the PC. The autoprint may be "turned OFF" under software control so that this output may be ignored if autoprint control is not desired. Autoprint is <u>only</u> a RTTY feature; it is not used for AMTOR and CW reception. Setting of the position of the wiper of U17 is also via software (Z-80 and PC). Any print threshold level may be set via keyboard command.

5.3 Transmit Modulator and Keying Circuits.

5.3.1 AMTOR/RTTY Tone Modulator (Figure 5.10)

AMTOR and RTTY transmit tones are generated by oscillator stage U15. The tone frequencies are: Mark = 2125 Hz (1275 Hz export) and Space = 2295 Hz (1445 Hz export). The tone frequencies are set with controls R76 and R77. See Chapter 6 for adjustment procedures. The output of U15 is a sine-wave with an amplitude of approximately 20 to 100 mV rms. Output level is set via control R59, available from the PCI-3000 rear panel. See Chapters 2 and 6 for adjustment procedures.

AMTOR and RTTY transmit data from the Z-80 microprocessor is level conditioned by amplifiers Q8 and Q9, driving pin 9 of U15. Encoding and polarity of AMTOR/RTTY transmit data is done under Z-80 software control.

The AMTOR/RTTY transmit tones are gated ON/OFF by the TONE signal from the Z-80 microprocessor. Tone ON/OFF control software includes time delays to avoid "hot-switching". The AMTOR transmit sequence is:

1. Set PTT to transmit state
2. Delay 5 ms and turn TX TONE ON
3. Delay 5 ms and send AMTOR/RTTY data
4. At end of AMTOR/RTTY data, turn TONE OFF
5. Delay 5 ms and set PTT to receive state

This sequence is always followed and minimizes any chance for transmitter "hot-switching" or loss of transmit data during an AMTOR transmit pulse.

Amplifiers Q10 and Q11 shift the level of the TONE ON/OFF signal to drive pin 1 of U15.

5.3.2 AMTOR/RTTY Transmit FSK Output (Figure 5.10)

Stages U20a, U10d, and U13c provide direct transmit data output to drive FSK input circuits of most transceivers. Both "TTL" (U10d) and "RS-232" (U13c) output are available, selected by jumper J2. The Mark/Space polarity is set by jumper J4. Refer to Chapter 2 to set these jumper plugs.

Note that FSK output does not provide the complete TX/RX sequencing described for AMTOR/RTTY tone generation since there is no TONE ON/OFF control. It is assumed that the manufacturer of the transceiver has included protection against "hot-switching" in FSK mode. However, the delay between PTT ON/OFF and transmit data flow is still provided for FSK output.

5.3.3 Push-To-Talk Control (Figure 5.11)

The transmitter/receiver Push-To-Talk (PTT) control line is switched by relay K1. The relay contacts are switched to ground in transmit ON state. Either positive or negative voltage, high-current or low-current PTT circuits may be switched by this relay output. D11 and R49 speed-up TX-to-RX switching in some transceivers. Refer to Chapters 2 and 7 for connection details.

5.3.4 CW Key Output (Figure 5.11)

The transmitter key input is switched by relay K2. This is a very fast relay and easily handles the 5 to 50 WPM Morse code speeds of the PCI-3000. The ON and OFF times of the relay are approximately 800 microseconds. Either positive or negative voltage key inputs may be switched by this relay. Refer to Chapters 2 and 7 for connection and maximum limitations.

5.3.5 SELCAL Output (Figure 5.11)

The PCI-3000 also includes a special output switch transistor that indicates when a successful "lock" has been achieved in AMTOR ARQ mode. This SELCAL output goes "low" (low impedance to ground) whenever your AMTOR ARQ mode SELCAL code is recognized. There are two keyboard selectable options for this output: (1) the SELCAL output is held "low" for the entire time that an ARQ QSO is in progress, and (2) the SELCAL output momentarily goes "low" at the start and again at the end of an ARQ connection. The "momentary" pulse of option (2) is approximately 1 second long. This output may be used to stop and restart the frequency memory scan feature of some transceivers.

NOTE: A careful reading of the transceiver manual is in order before using this connection. Some additional circuitry and modifications of the transceiver may be necessary to fully utilize this feature. A "START/STOP SCAN" feature is not currently a rear-panel input for any standard amateur radio transceivers. HAL assumes no responsibility for the effectiveness of such modifications. Various amateurs have made this feature work well and it is suggested that the PCI-3000 owner consult these individuals for more details. HAL cannot modify transceivers for this mode.

5.4 I/O Connections and Power Supply (Figure 5.12)

All I/O connections to the PCI-3000 are made through the 25-pin rear panel connector. This connector (J3) is a standard type "DB-25S" (socket type). Signals and pin numbers are shown in TABLE 2.1 in Chapter 2. Please note the maximum conditions for each connection. Each I/O signal connection is by-passed directly at J3 to avoid RFI from the computer or transmitter.

NOTE: Connector J3 is a type "DB-25 connector" and could be mistaken for either a PC parallel printer connector - or for a serial I/O connector. J3 is neither and does not use the same pin-out as those used for RS-232 serial data I/O. All 25 pins of J3 are used for radio signals and for the "host" control port. However, the signals and pin connections do match those to the HAL PCI-2000 RTTY/CW PC Interface product. Therefore, PCI-2000 cables and the PCI-2000 PCI-EXT and SPT-1 may be used directly with the PCI-3000. In addition, a new accessory, the SPT-2 Spectra-Tune may be directly connected to the PCI-3000. The SPT-2 may also be used with the PCI-2000.

Avoid accidentally connecting a printer or serial I/O cable directly to PCI-3000 connector J3.

The PCI-3000 obtains DC power from the personal computer via the computer bus connector. Logic circuits are powered directly from the computer's +5 VDC power supply. However, additional +8 V and -8V regulators (VR1 and VR2) are used to power all PCI-3000 analog circuits. This isolates the PCI-3000 modulator and demodulator circuits from noise and voltage variations common on a personal computer's +12 V and -12 V power supply outputs.

The three DC power voltages (+5, +12, and -12) are also connected to J3 to power the SPT-2 accessory. Be careful when making I/O connections to J3 to avoid shorting pins 21, 22, or 23 to ground.

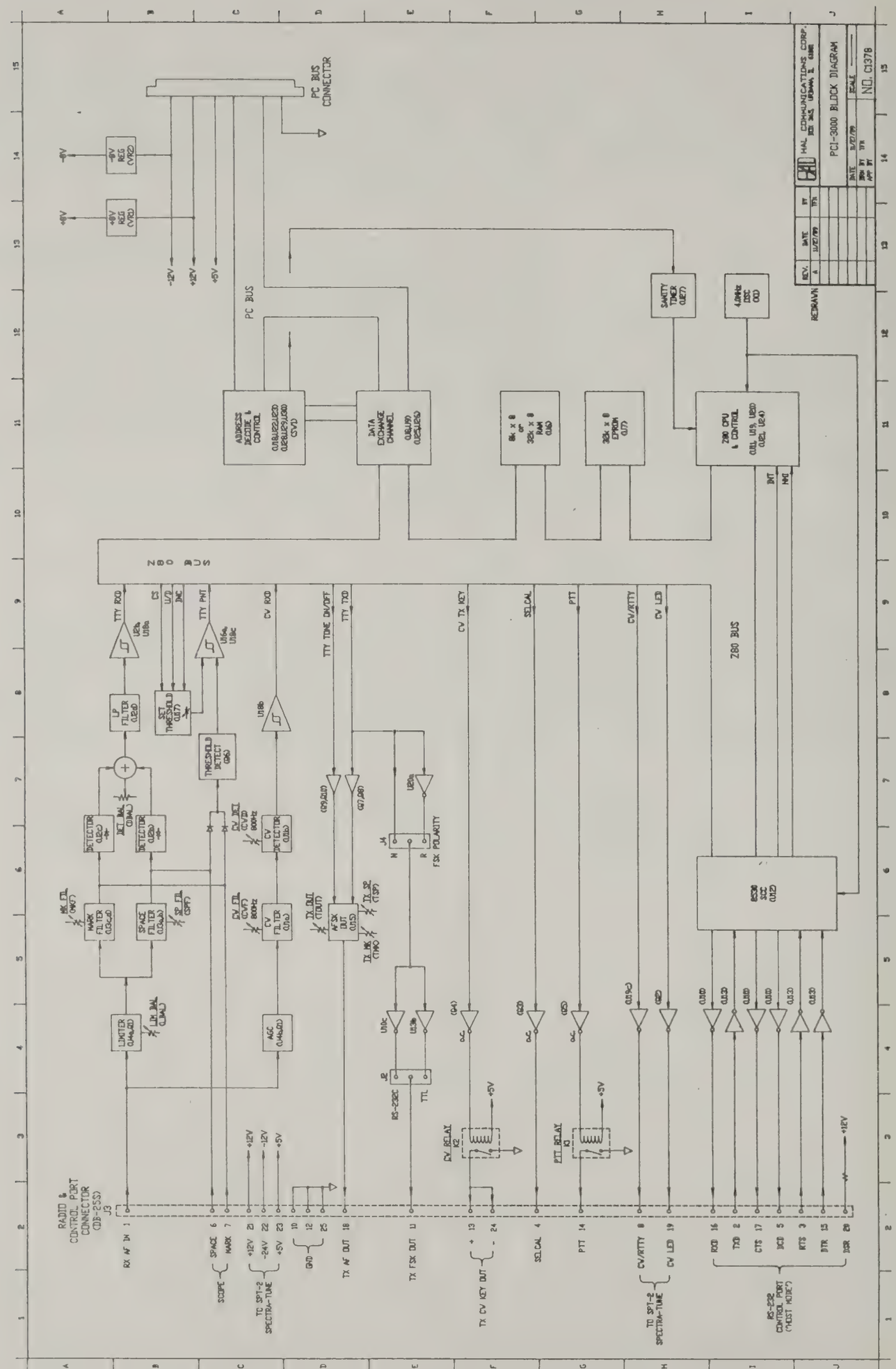

Figure 5.1 PCI-3000 Block Diagram

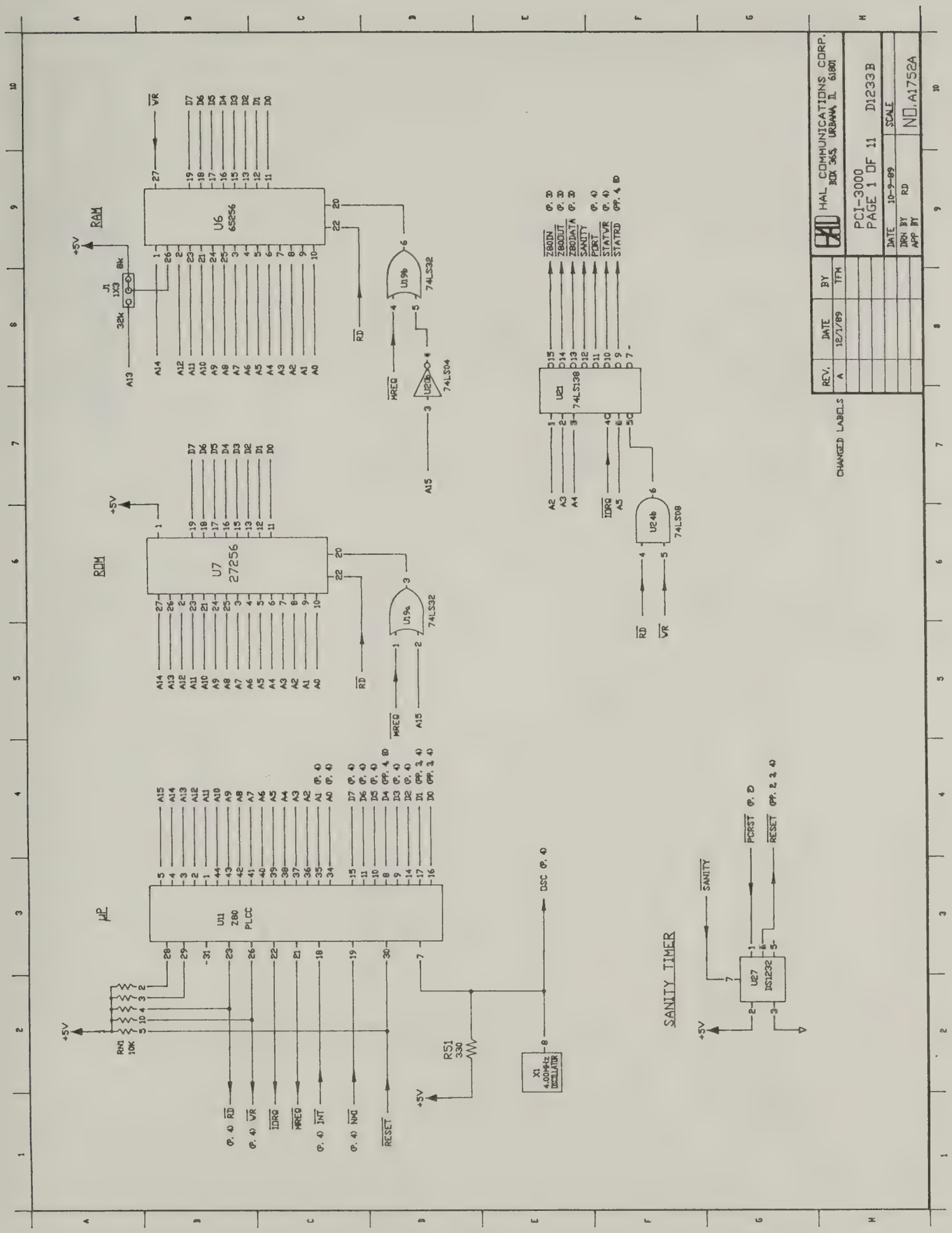

Figure 5.2 Microprocessor, RAM, ROM, Sanity Timer

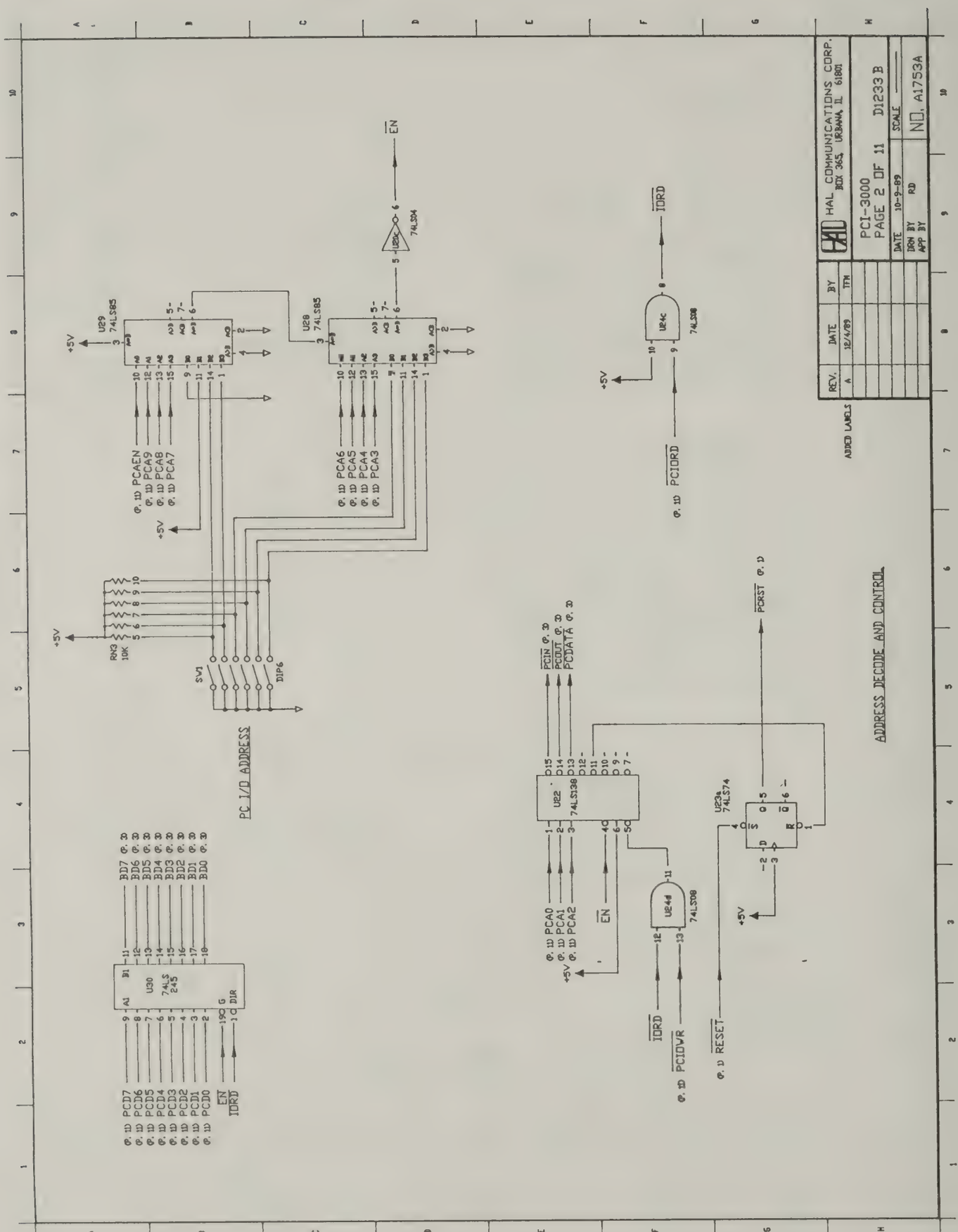

Figure 5.3 PC Buss Interface, I/O Address

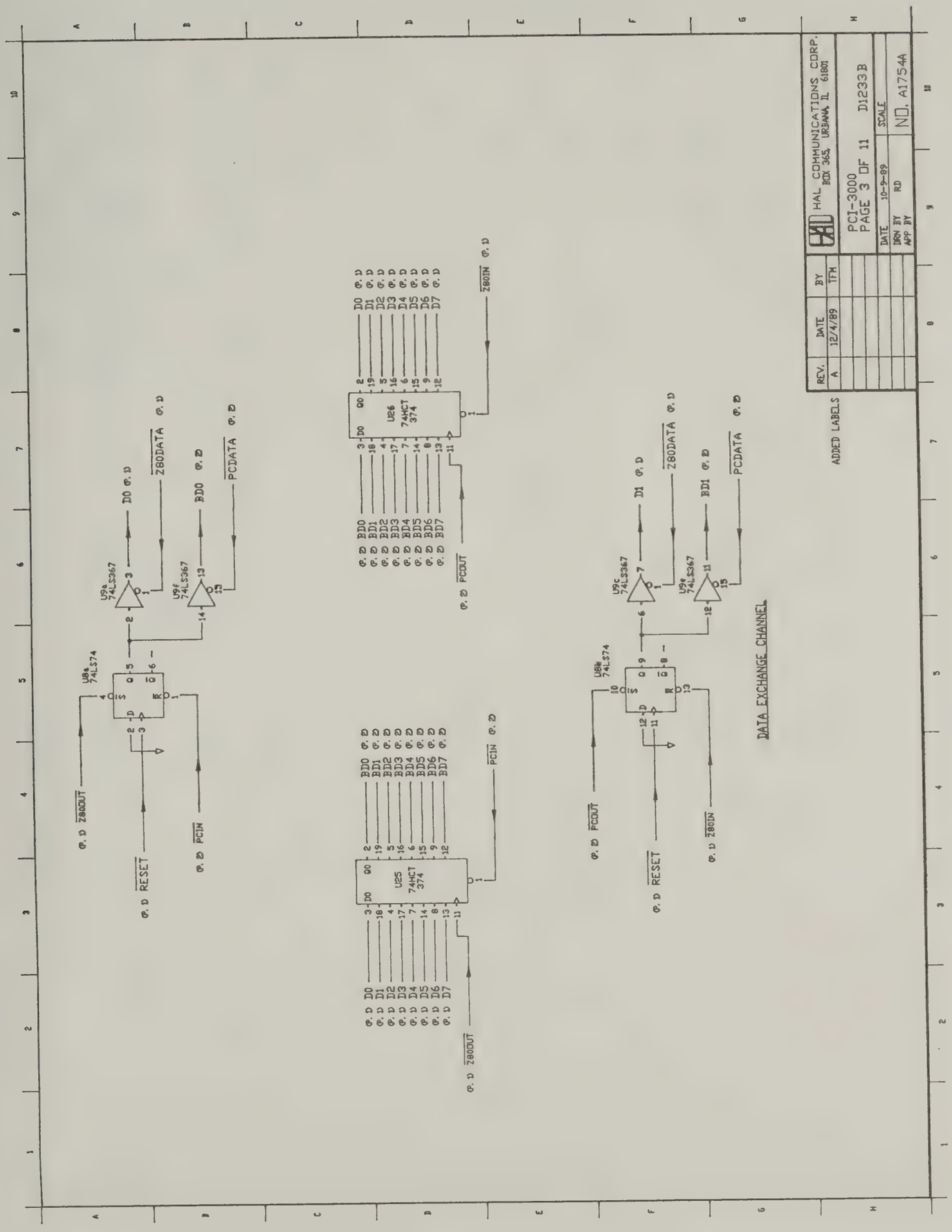

Figure 5.4 PC Buss Interface

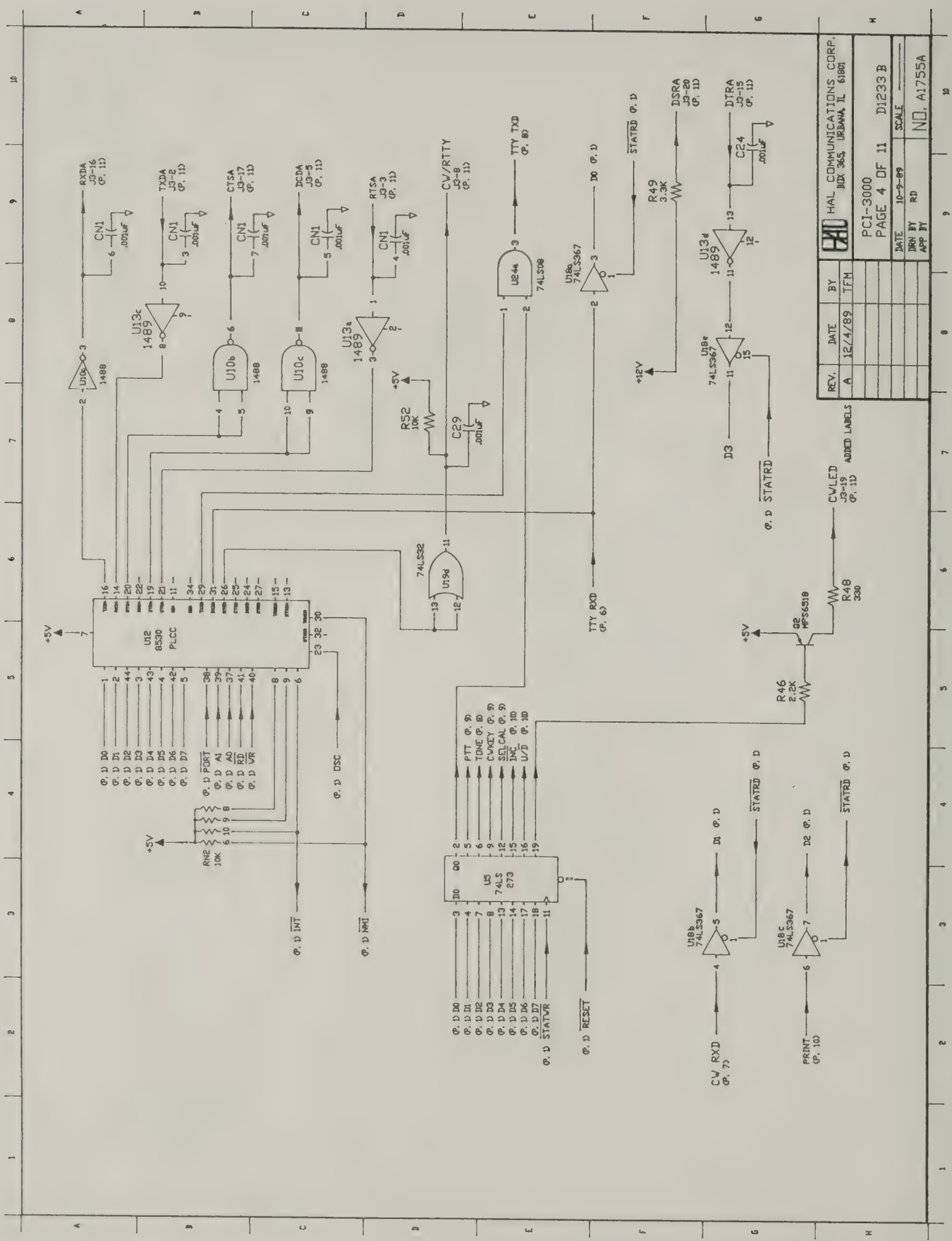

Figure 5.5 Timers, Host Port

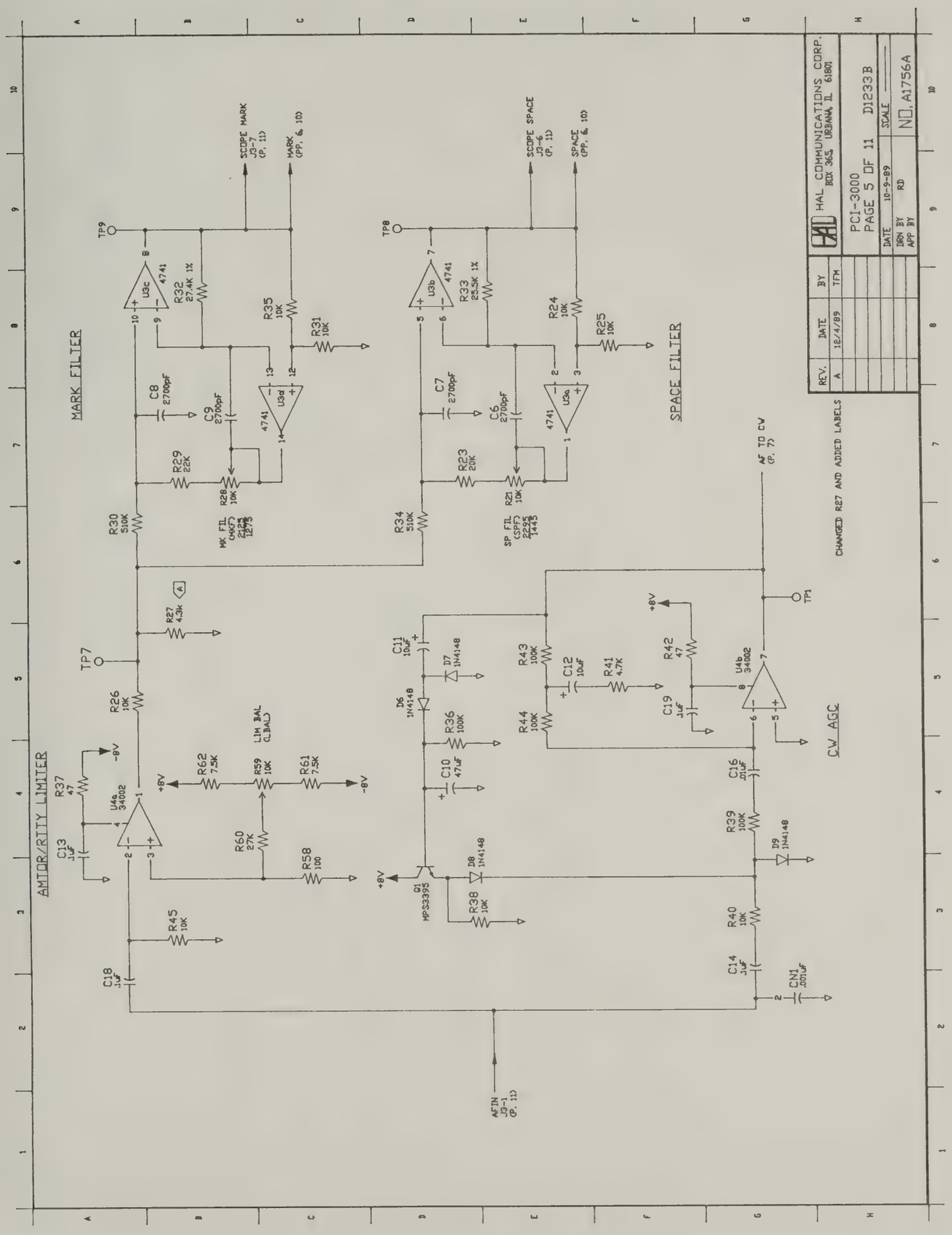

Figure 5.6 Input Limiter & AGC, AMTOR/RTTY M/S Filters

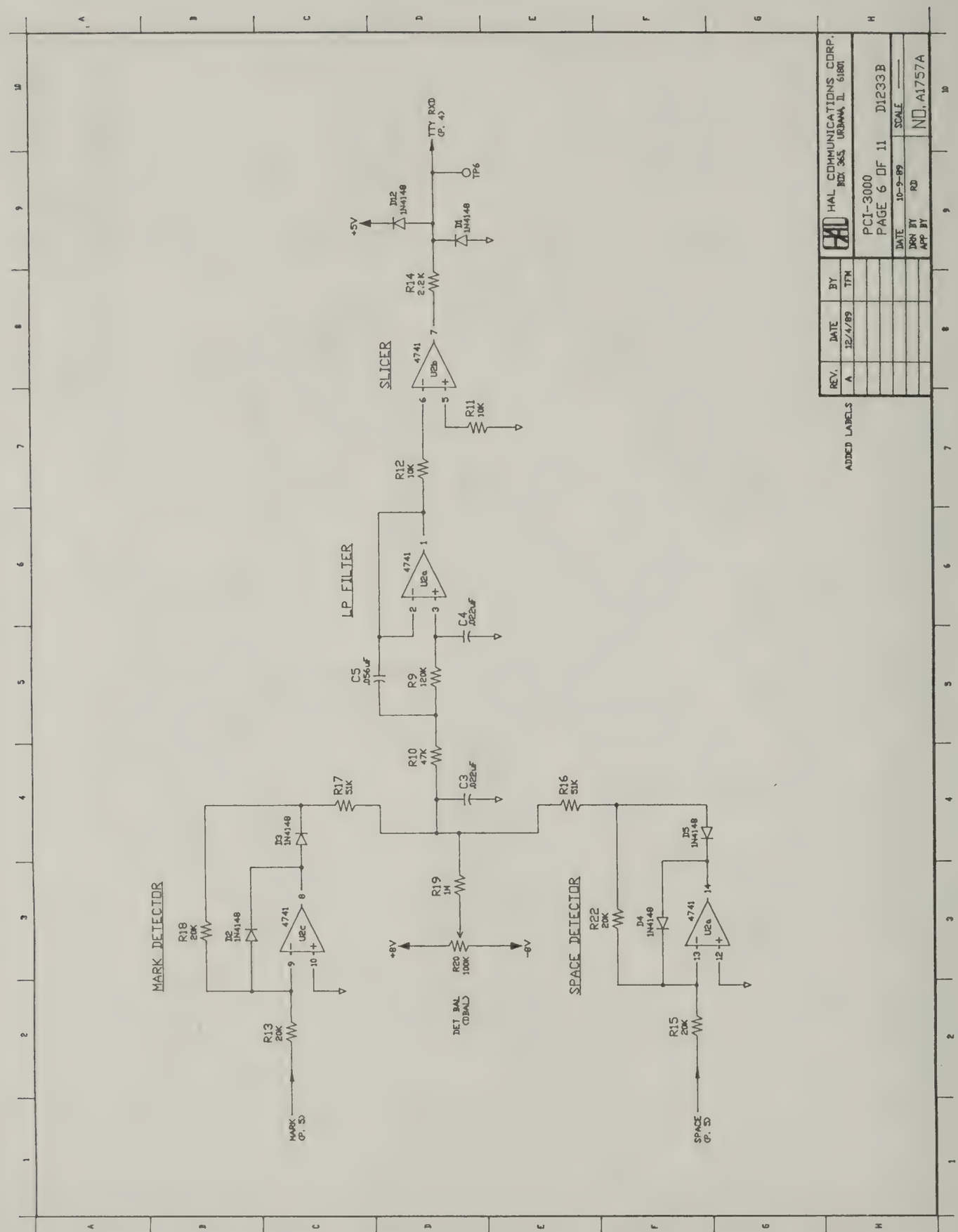

Figure 5.7 AMTOR/RTTY Detector, LP Filter, Slicer

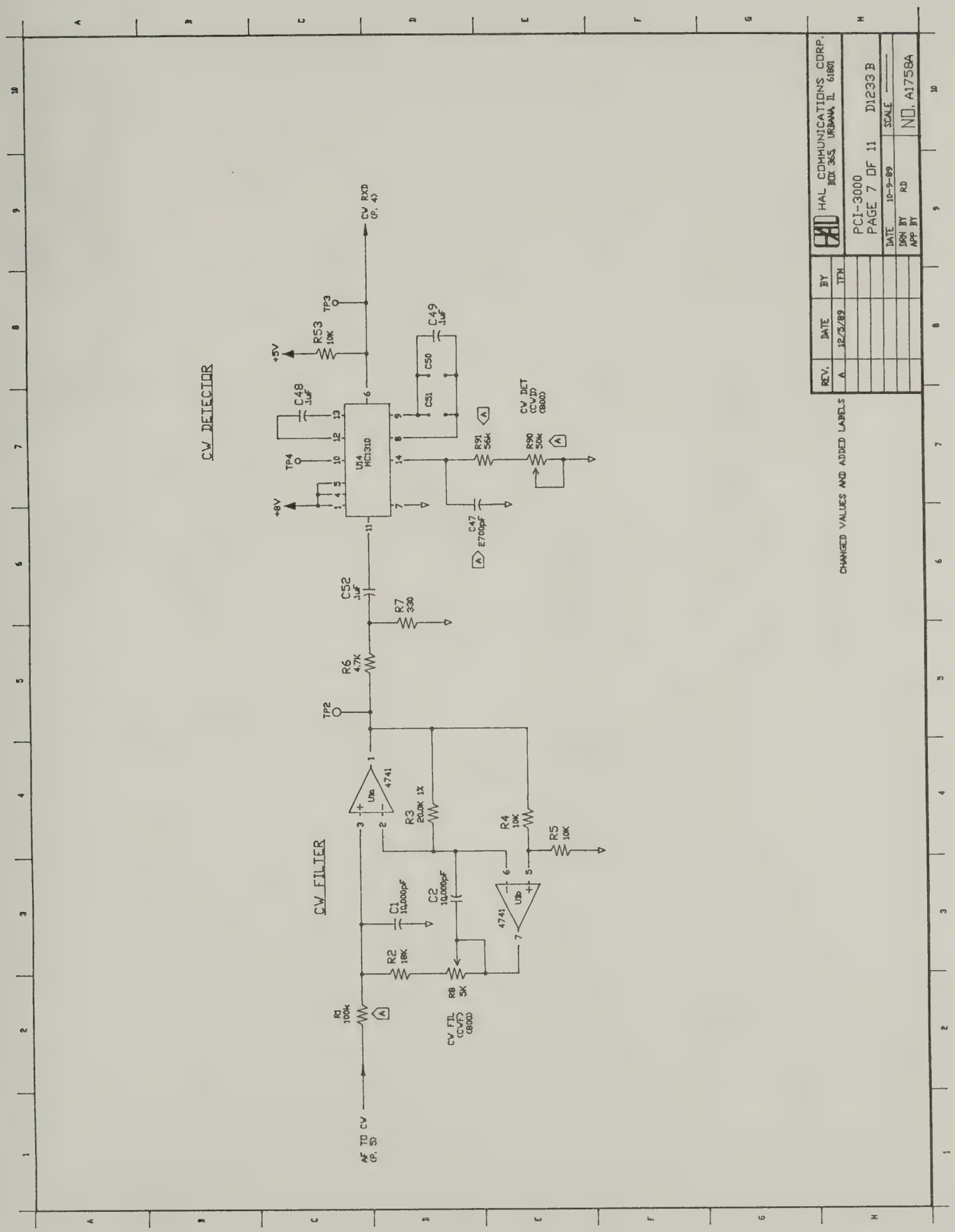

Figure 5.8 CW Filter, Detector

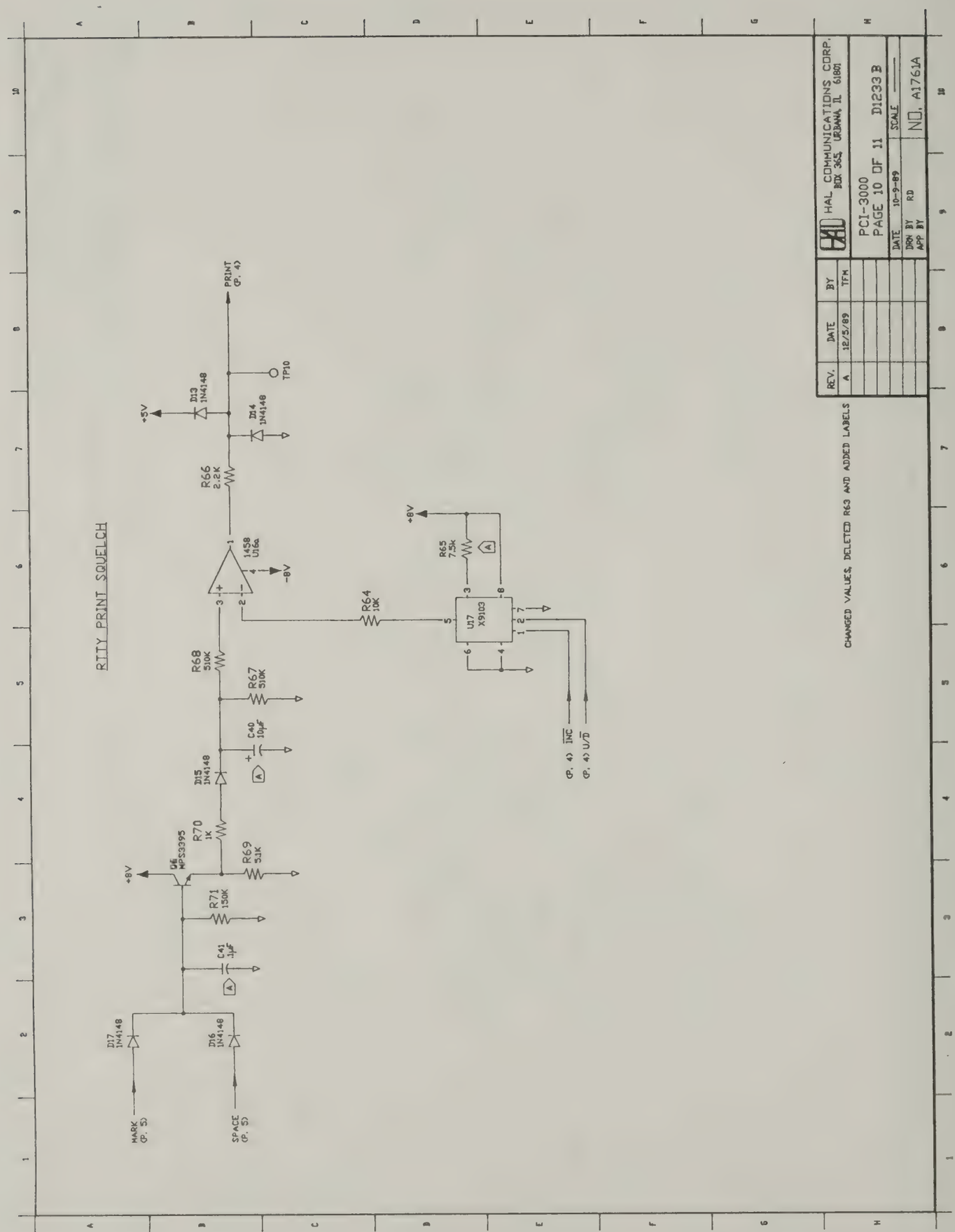

Figure 5.9 RTTY Autoprint

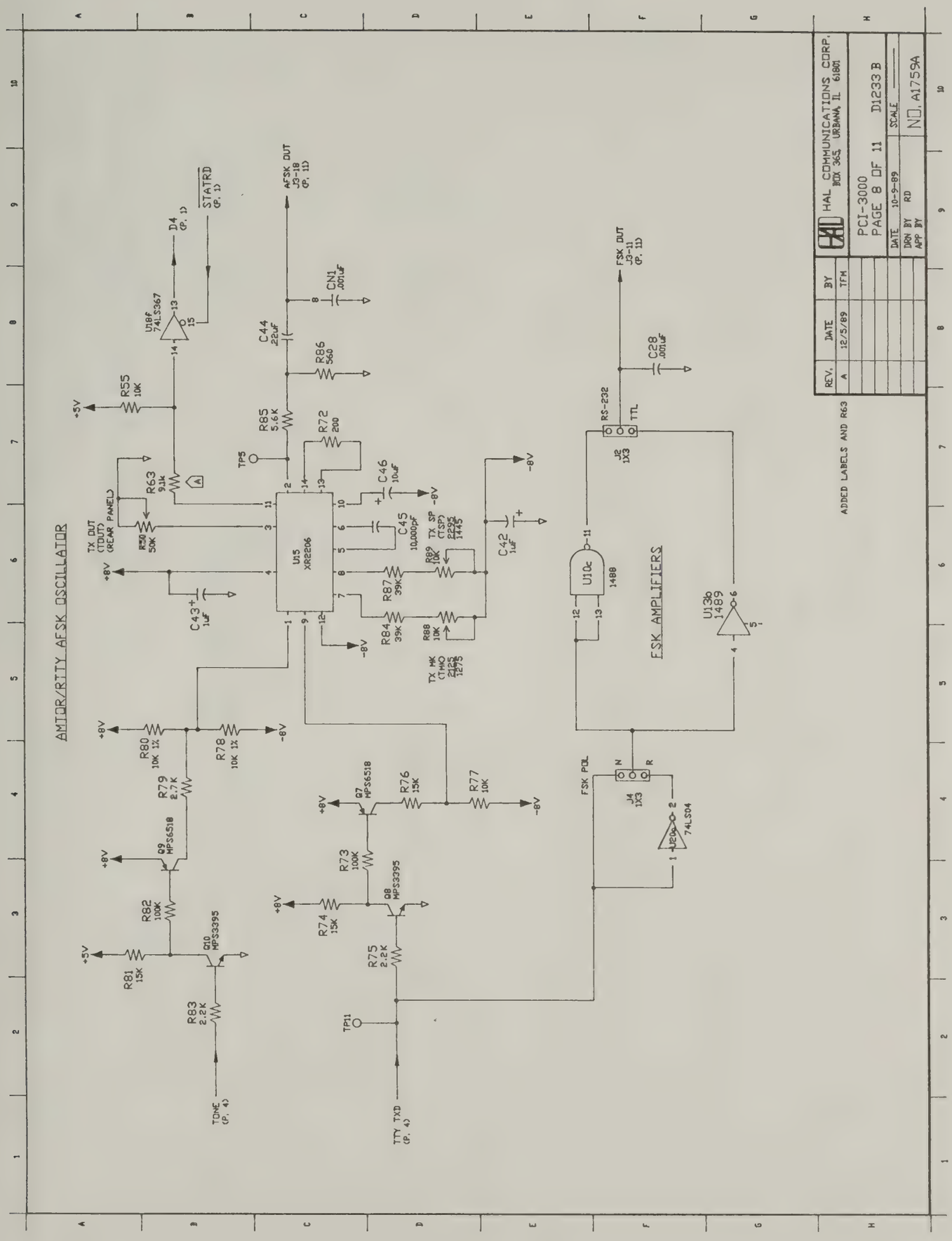

Figure 5.10 AMTOR/RTTY Transmit Modulator, FSK

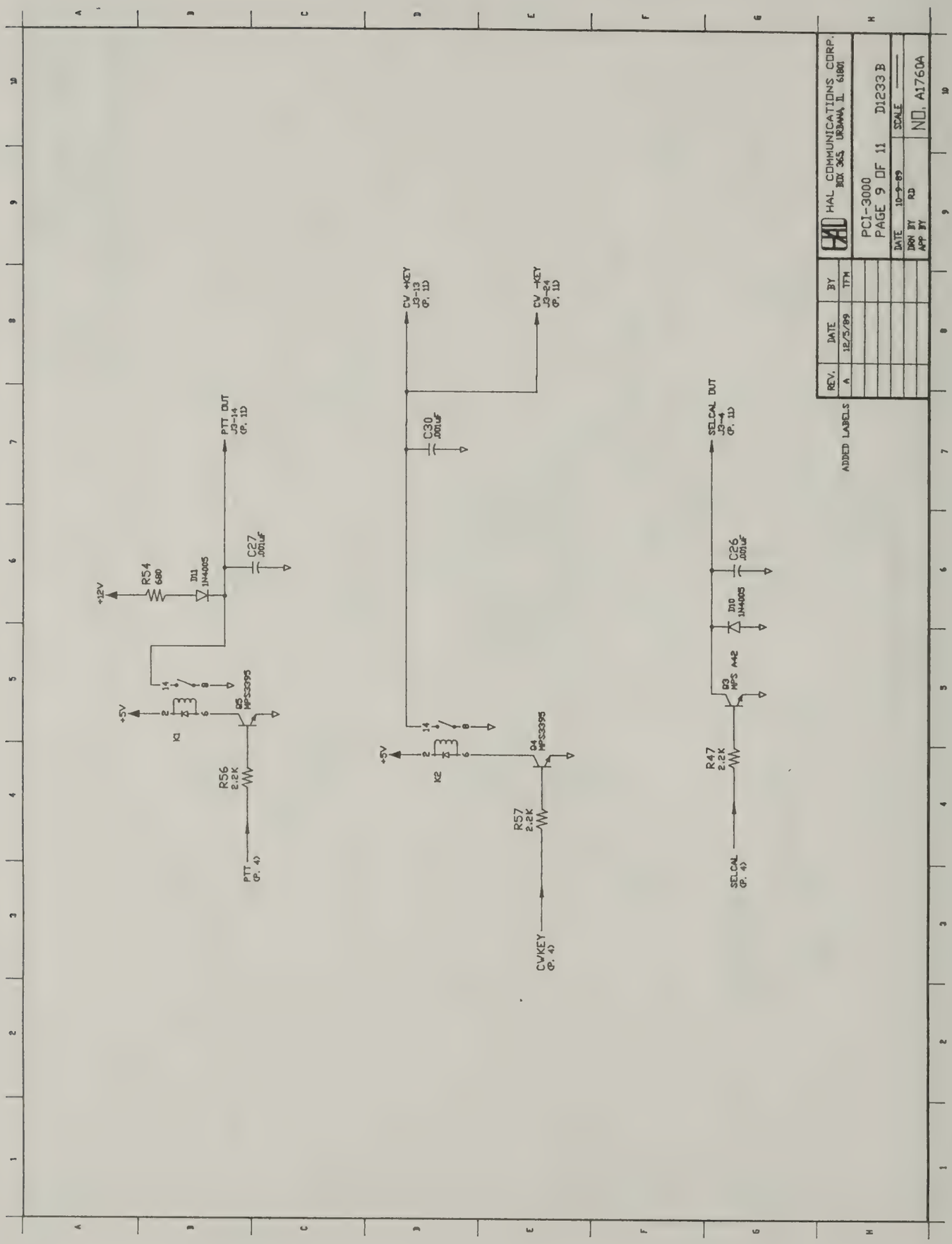

Figure 5.11 PTT, CW Key, SELCAL Outputs

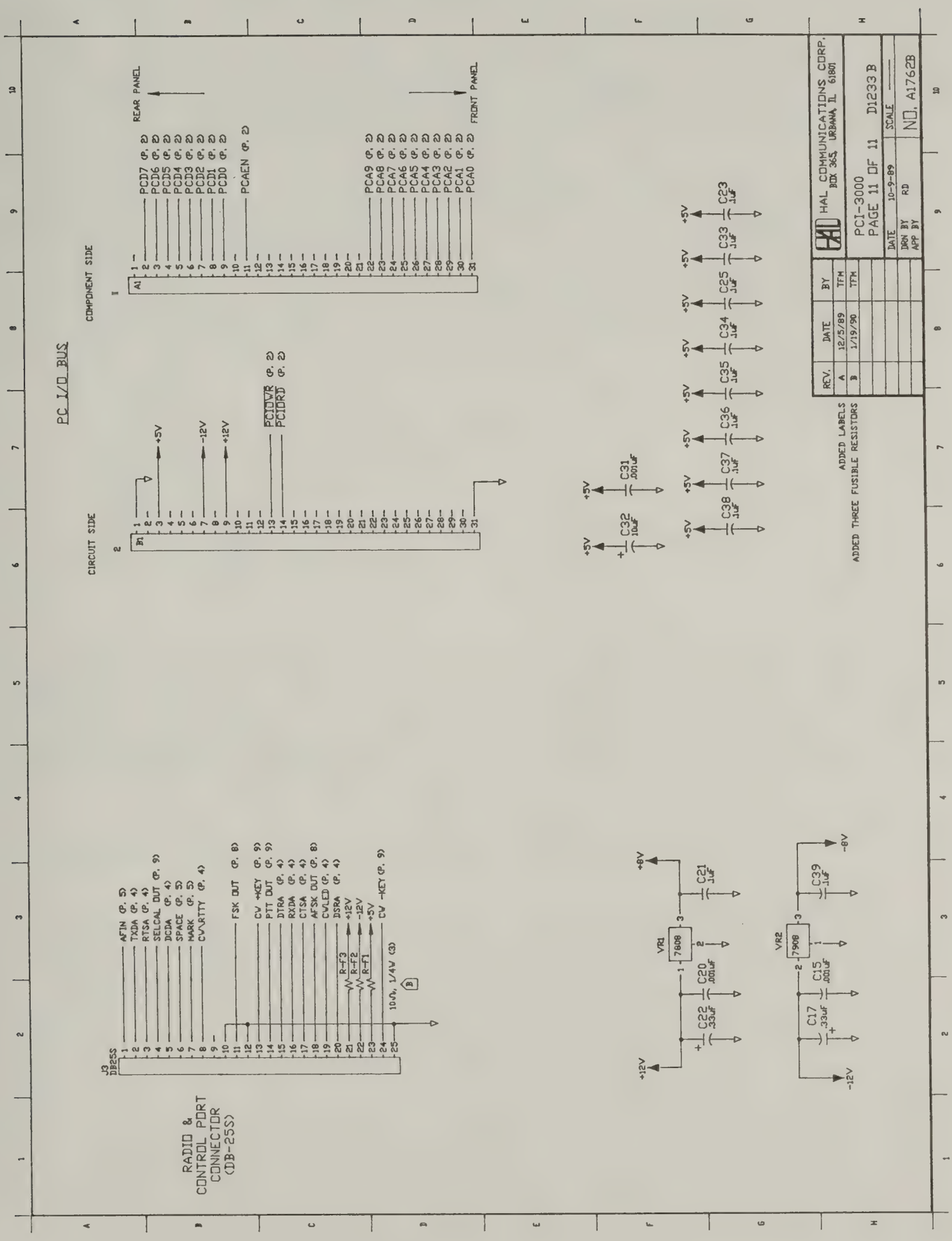

Figure 5.12 I/O Connectors, Voltage Regulators

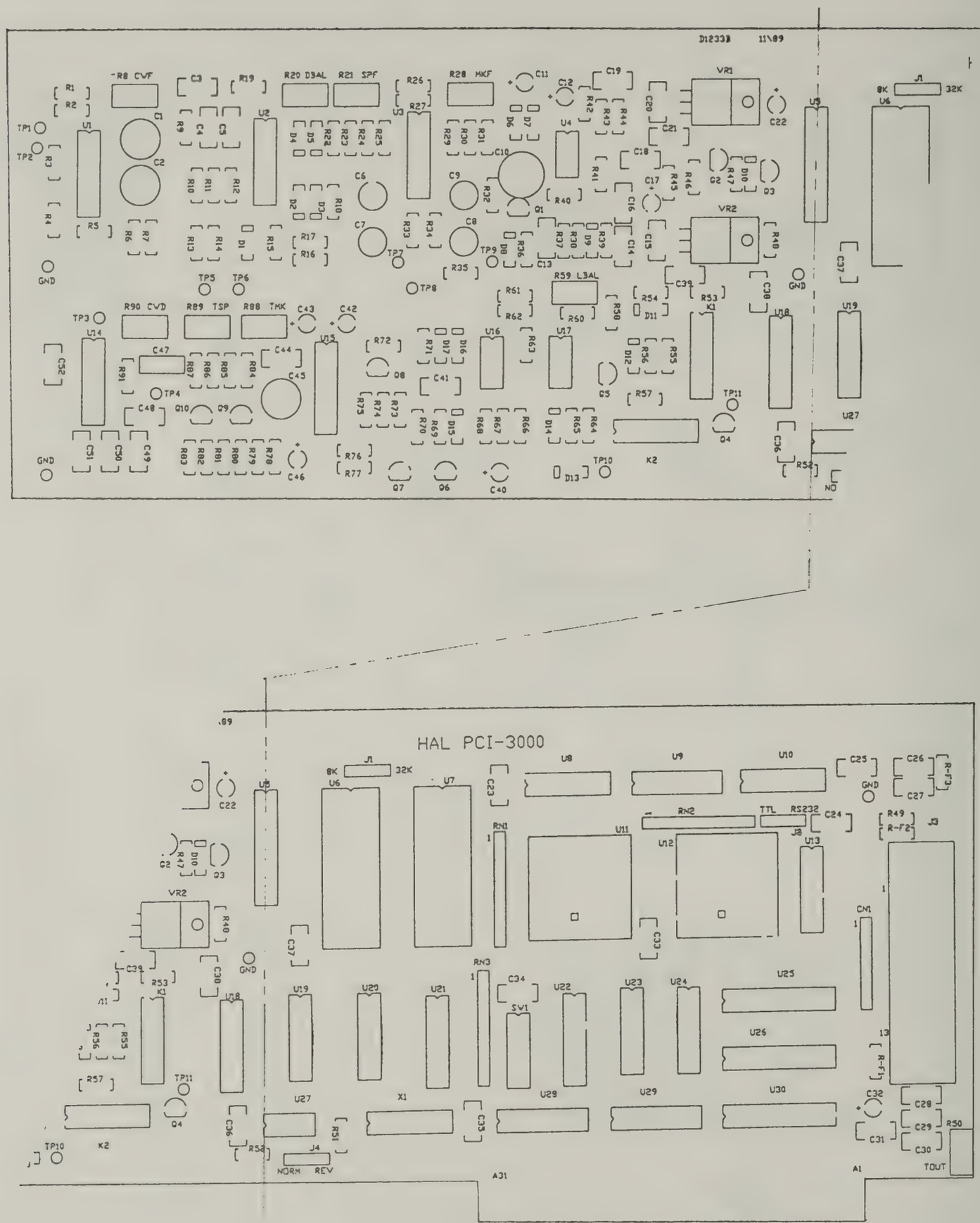

Figure 5.13 PCI-3000 Circuit Board

CHAPTER 6
TEST AND ALIGNMENT

This Chapter provides detailed alignment instructions for the PCI-3000 circuit board. The PCI-3000 should not require re-alignment in normal use. However, these instructions are provided in case you should need to make extensive repairs to your PCI-3000.

Frequent reference will be made to Schematic and the Parts Placement diagrams in Chapter 5. Parts placement and test points are all shown in Figure 5.13. The pertinent schematic will be referenced as appropriate.

With the exception of setting the PC I/O address, all alignment adjustments are in the "analog" modem section of the PCI-3000. The following test equipment is recommended:

AC Voltmeter - HP400FL or equivalent
Audio Signal Generator - HP3311A or equivalent
Audio Frequency Counter - Fluke 1911A or equivalent
Test Oscilloscope - Tektronix 2225 or equivalent
PC-XT Extender Circuit Board - Techmar 200017 or equivalent
HAL SPT-2 SPECTRA TUNE

It is assumed that PC-AMTOR is available and running. It will be used to set code, mode, and other parameters on the PCI-3000 circuit board. Also, testing of the Host Port will require a serial I/O patch cable and a terminal program that will run in your PC. It is also assumed that the following steps are done in the order given, from section to section. Instrument connections of one section carry over to the next section unless otherwise noted.

These instructions give the frequencies for the U.S. domestic version but indicate the corresponding export version frequencies in the format [1500].

The following instructions assume use of the SPT-2 SPECTRA-TUNE for input and output connections. If the SPT-2 is not available, refer to Chapter 2 and use the equivalent direct input/output connections shown in Table 2.1.

6.1 AMTOR/RTTY Alignment

Load PC-AMTOR and set it to "RTTY-BAUDOT" at 110 baud. PC-AMTOR includes a frequency measuring command to test the AMTOR/RTTY AFSK tone frequencies. These tones will be tested first and then used to align various stages of the receive demodulator.

6.1.1 AFSK Tone Alignment (Figure 5.10)

1. Enter the Test Mode option in the CONFIGURATION menu (type [F1], F, C, T). This feature provides automatic measurement of the Mark and Space AFSK transmit tones of the PCI-3000. The [Space Bar] is used to toggle between three test states: MARK, SPACE, and ALTERNATE.

2. Choose the MARK Set Tone option and adjust control R88 so that 2125 Hz is displayed on the Test Mode screen. See Figure 5.13 to locate R88. Be patient and use small increments when adjusting R88. There is an approximate 2 second delay between each frequency measurement. Try to get with ± 2 Hz of "2125" Hz ["1275" Hz for Export units].

3. Type the [Space Bar] to change to SPACE and adjust control R89 to get a frequency of 2295 Hz [1445 Hz for Export units].

4. Connect the oscilloscope and AC Voltmeter (HP400FL) to "AF OUT" (J3, pin 18, SPT-2 "AF OUT"). The output signal should have a sinusoidal waveform and an amplitude of -30 dBm (30 mV rms). The amplitude may be adjusted with control R50 on the PCI-3000 rear panel. Use the [Space Bar] to toggle between MARK, SPACE, and ALTERNATE. The amplitude difference between Mark and Space should be less than 1 dB. Set the output level to -30 dBm (30 mV).

5. Exit test mode by typing [Esc]. This should turn the AFSK tones OFF. Increase the AC Voltmeter and oscilloscope sensitivity to view any "leak-through". The residual output should be less than -50 dBm (3 mV).

The PCI-3000 AFSK generator will be used in tests that follow.

6.1.2 Limiter Alignment (Figure 5.6)

1. Connect a 100K resistor in series with the PCI-3000 "AF OUT" (J3, pin 18, SPT-2 AF OUT) and "AF IN" (J3, pin 1, SPT-2 AF IN). This resistor provides a 20 dB attenuation of the AFSK output.

2. Re-enter Test Mode and select the MARK Set Tone option.

3. Connect the oscilloscope to TP7, the output of the limiter stage (U4a). Adjust amplitude and time base to get a 2125 Hz square wave on the oscilloscope screen. The square wave should be centered about 0 VDC and have an amplitude of approximately 10 V P-P. [1275 Hz for export models]

4. Watching the oscilloscope, reduce the AFSK output level (R50) until the oscilloscope trace just barely shows clipping of the sine wave.

5. Adjust control R59 (LIM BAL) so that both the positive and negative sine wave peaks are clipped equally. This will require some minor adjustment of the AFSK output level.

6. Reduce the AFSK output level (R50) until the sine wave is just barely clipped. This is the limiter threshold of the PCI-3000 and should be approximately -50 dBm (3 mV rms). Check to be sure that the threshold levels for MARK and SPACE are similar (within 3 dB).

6.1.3 Mark/Space Filter Adjustment (Figure 5.6)

1. Remove the series 100K resistor used in step 1 of 6.1.2 and connect the PCI-3000 AF OUT directly to AF IN (J3 pin 18 to pin 1, or SPT-2 AF OUT to AF IN).

2. Move the oscilloscope connection to the Mark Tuning CRT Output (J3 pin 7 or SPT-2 "M" connector).

3. Also connect the AC Voltmeter (HP400FL) to the Mark Tuning CRT Output.

4. Using Test Mode, set for a MARK tone output.

5. The signal on the oscilloscope should be an undistorted sine-wave with an amplitude of +10 dBm (3V rms).

6. Adjust control R28 (MARK) for maximum indication on the AC Voltmeter. The amplitude should be approximately +10 dBm (3V rms).

7. Move the oscilloscope and AC Voltmeter (HP400FL) to the Space Tuning CRT output (J3 pin 6 or SPT-2 "S" connector).

8. Use the [Space Bar] to change to a SPACE tone output.

9. The signal on the oscilloscope should be an undistorted sine-wave with an amplitude of +10 dBm (3V rms).

10. Adjust control R21 (SPACE) for maximum indication on the AC Voltmeter. The amplitude should be approximately +10 dBm (3V rms).

11. Type [Esc] to exit Test Mode.

6.1.4 Detector Balance Adjustment (Figure 5.7)

1. Disconnect the AC Voltmeter and oscilloscope from the SPACE CRT output.

2. Connect the oscilloscope to U2, pin 1.

3. Reconnect the 100K resistor in series between AF OUT and AF IN as was done in Step 1, Section 6.1.2.

4. Enter Test Mode and use the [Space Bar] to select ALTERNATE mode.

5. Adjust the oscilloscope amplitude, time base, and trigger so that a sequence of data pulses are displayed.

6. Using control R50 on the PCI-3000 rear panel, reduce the AFSK output until the detected data appears "noisy" and then increase the amplitude slightly.

7. Note the DC level of the detected data pulses. There should be an equal excursion of both positive and negative pulses. Adjust control R20 (DET BAL) until the positive and negative pulse excursions are the same.

8. Connect the AC Voltmeter (HP400FL) to AF OUT and reset the AFSK output level (R50) to be -30 dBm (30 mV).

9. Type [Esc] to exit Test Mode.

This completes alignment of the AMTOR/RTTY demodulator and modulator.

6.2 CW Alignment

6.2.1 CW AGC Testing (Figure 5.6)

1. Disconnect all previous test equipment and AF IN / AF OUT connections.

2. Connect the audio generator to "AF IN" (J3 pin 1 or SPT-2 "AF IN"). Set the frequency to exactly 800 Hz and the amplitude to 0 dBm (0.7V rms). [Same frequency for export models]

3. Connect the oscilloscope and AC Voltmeter (HP400FL) to TP1. The signal should be a sine-wave and have an amplitude of approximately 0 dBm (0.7 V rms).

4. Decrease the audio generator output to -30 dBm. The signal at TP1 should still be sinusoidal and have an amplitude of -6 dBm or greater.

6.2.2 CW Filter Alignment (Figure 5.8)

1. Return the audio generator output to 0 dBm.

2. Connect the oscilloscope and AC Voltmeter (HP400FL) to TP2. Observe an 800 Hz sine-wave with an amplitude of +6 dBm.

3. Confirm that the audio generator is still exactly 800 Hz.

4. Adjust control R8 (CW FIL) for a maximum AC Voltmeter reading.

6.2.3 CW Detector Adjustment (Figure 5.8)

1. Connect the oscilloscope to TP3. This will be a 0 to 5V digital signal. With the audio generator set to 800 Hz, it should be at a "logical 0 state" (less than 1.5 VDC).

2. Decrease the output of the audio generator until TP3 changes to a "logical 1 state" (greater than +3.5 VDC). Increase the audio generator amplitude to just above where TP3 changes to the "0 state".

3. Locate control R90 (CW PLL). Rotate R90 so that TP3 again changes back to the "1 state". Note this position. Rotate R90 in the other direction so that TP3 changes back to "0" and then again switches to the "1 state". Note this control position.

4. Set control R90 so that it is midway between the two settings found in step 3 above.

5. With the audio generator still set to 800 Hz, gradually decrease its output amplitude until TP3 again changes to the "1 state". This is the "minimum signal threshold" for CW signal detection. The audio generator amplitude should be -30 dBm or lower at this threshold point.

6. Increase the audio generator output to -10 dBm.

7. Observing TP3, find the upper and lower frequency limits at which TP3 changes from the "0 state" to the "1 state". Note both frequencies. The difference between the upper and lower frequency is the CW detection bandwidth. It should be 200 Hz or greater. You may wish to "fine-tune" R90 adjustment so that the "pull-in" upper and lower frequencies are equally spaced above and below 800 Hz.

This completes all analog alignment of the AMTOR/RTTY and CW sections of the PCI-3000. All other sections are digital in nature and require no alignment. Disconnect all test equipment from the PCI-3000.

Host Mode operation and use is discussed in Chapter 4. *There are no adjustments required for Host Mode.*

Two other circuit board options may be set - I/O address and FSK jumper. *See Appendix B for PC I/O address options and Appendix C for FSK jumper selection.*

CHAPTER 7
PC-AMTOR / PCI-3000
SPECIFICATIONS

INPUT/OUTPUT:

AF IN:	Audio from receiver; 30 mV to 3 V rms
AF OUT:	AMTOR/RTTY audio to transmitter; -30 dBm (30 mV rms)
FSK:	AMTOR/RTTY FSK output; TTL or RS-232, normal or reverse
PTT:	Push-To-Talk control output; ±50 V, 100 ma maximum
KEY:	CW key output to transmitter; ±50 V, 100 ma maximum
HOST PORT:	RS232 DCE I/O Control Port for use with APLink
SEL-CAL:	AMTOR SEL-CAL output; NPN transistor, +50V, 100 ma maximum
MARK:	AMTOR/RTTY Tuning Scope Mark Output; 10V p-p
SPACE:	AMTOR/RTTY Tuning Scope Space Output; 10V p-p

DATA CODES and RATES:

AMTOR:	7-bit Synchronous Code, CCIR-476 and CCIR-625 100 baud, ARQ, FEC, SEL-FEC, and LISTEN modes 4-letter or 7-letter SEL-CAL
BAUDOT:	5-bit Asynchronous Code, U.S. Baudot or CCITT #2; 45, 50, 57, 74, or 110 baud.
ASCII:	8-bit Asynchronous Code, ANSI X3.41968 45, 50, 57, 74, or 110 baud; upper and lower case letters.
MORSE:	Standard Continental Morse Code 5 to 50 WPM; all letters, numbers, prosigns, and punctuation
SEARCH:	Automatically selects code, rate, and polarity of received signals - AMTOR, Baudot, ASCII, or CW.

MODEMS:

AMTOR: & RTTY:	Full limiting demodulator; separate Mark and Space filters and detectors, active post-detection filter. 2125 Hz / 2295 Hz (U.S.) 1275 Hz / 1445 Hz (Export) Keyboard adjustable threshold Print Squelch for RTTY.
MORSE:	AGC, filter, and PLL detector. 800 Hz center, 200 Hz bandwidth

DISPLAY:

FORMAT:	Split screen with separate receive and transmit buffer areas. Receive and transmit buffers are 250 lines long. Status indicators on Top, middle, and bottom lines. Pull-down COMMAND menu and "Hot-Key" control
SCREEN:	Standard Personal Computer Video including Monochrome, CGA Color, EGA Color, and VGA Color.

OPERATION:

SOFTWARE: PC-AMTOR personal computer software includes split-screen, pull-down menu windows, "hot keys", programmable messages, Call Directory, Configuration menu and files, Save to disk, Send from disk, Transmit Editor, Custom parameters for each code and mode.

MENUS: Main COMMAND Menu
CODE Menu (AMTOR, RTTY, CW, SEARCH)
MODE/RATE Menu (AMTOR ARQ, FEC, SEL-FEC, LISTEN modes)
(RTTY baud rates; CW transmit speed)
CONTROL Menu (TX Control, WORD/CHAR, Polarity, Sync, USOS)
MESSAGES Menu (ID, HERE IS, CALL, Call Signs & SEL-CAL)
FILES menu (Load TX Buffer, Save To Disk, Send From Disk)
CONFIGURATION Menus (2 pages, all parameters)

STORAGE: 250 Line Receive Buffer; 250 Line Transmit Buffer
Save To Disk File
ID of your station (SEL-CAL and Call Sign)
CALL of other station (SEL-CAL and Call Sign)
CALL DIRECTORY (SEL-CAL and Call Sign of 5 stations)
HERE IS 1 & HERE IS 2 (2, 32-character messages)
ANSWERBACK (16 character AMTOR WRU response message)
CCIR 476 AMTOR SEL-CAL (4 letters)
CCIR 625 AMTOR SEL-CAL (7 letters)
CONFIGURATION file to save default parameters

PRINTER: ON/OFF control of LPT1 PC printer device

HOST PORT: Alternate Control port for use with other PC-based terminal software such as APLink and "mailbox" programs (not HAL).

COMPATIBILITY:

IBM*-Compatible PC, PC-XT, PC-AT, PC-286, PC-386.
Must be IBM BIOS compatible; MS-DOS / PC-DOS V2.0 and higher
Two floppy disks or one floppy disk and one hard disk minimum
512K RAM minimum; PC-AMTOR furnished on one 360K 5.25" diskette

MECHANICAL:

Full size IBM PC circuit board.
All I/O connections via one DB-25S connector
0.75 lbs (.34 kg) net, 3.0 lbs (1.3 kg) shipping

WARRANTY: One year on parts and labor

ACCESSORIES:

DS-3200: Radio Data Communications Terminal; PC-Compatible and "radio quiet" system includes keyboard, monitor, MS-DOS. Two 360K floppy disk drives or one hard disk and one floppy disk drive. Rack Mountable.

SPT-2: SPECTRA-TUNE Tuning Indicator for PCI-3000. Indicates audio frequency spectra of received AMTOR, RTTY, and CW signals. Includes "fan-out" of radio connections to "RCA-type" phono connectors.

FIL-1: Accessory AMTOR/RTTY filter for installation inside SPT-2. Filter Bandwidth = 500 Hz.

LIMITED WARRANTY

HAL Communications Corp. of Urbana, Illinois, hereby warrants to the purchaser that the product herein described shall be free from defects in materials and workmanship, and from failure of operation from ordinary use, for a period of one year from the date of sale to the purchaser.

In the event of a defect in materials or workmanship during the warranty period, HAL Communications Corp. will, at its own expense, repair the defective unit and replace any defective parts. Cost of shipping the unit to HAL Communications Corp. as well as costs of removal and reinstallation of the unit shall be paid by the purchaser. HAL Communications Corp. will pay the shipping costs incurred in returning the unit to the purchaser.

To obtain warranty service, the customer should:

1. Notify, as soon as possible, the Customer Service Department of HAL Communications Corp., Box 365, Urbana, Illinois, 61801, of the existence of a possible defect.

2. At the time of notification, identify the serial number, and the possible defect.

3. HAL Communications will issue a Return Authorization Number at this time.

4. Return the unit, freight prepaid. Include in the shipping carton a reference to the Return Authorization Number and a brief description of the problem.

Correct installation, use, maintenance, and repair are essential for proper performance of this product. The purchaser should carefully read the equipment manual. The purchaser will be billed for labor and shipping charges on any unit determined by HAL to be in working order when received for repair.

This warranty does not apply to any defect which HAL Communications Corp. determines is due to any of the following:

1. Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts;

2. Misuse, abuse, neglect, improper installation, or improper operation, including improper AC power and RF grounding techniques.

3. Accidental or intentional damage.

All implied warranties are limited in duration to a period of one year from the date of purchase by the original retail purchaser. HAL Communications Corp. disclaims any liability for incidental or consequential damages arising out of the use of, or inability to use, this product. This warranty gives you specific legal rights, but there may be additional rights.

APPENDIX A
REFERENCE TABLES

The two manuals for the PCI-3000 and PC-AMTOR contain many useful tables of data. Often, all the information you may need is to be found in one table or the other. In the interest of convenience, ALL of the Tables from this REFERENCE MANUAL and the OPERATOR'S GUIDE are reproduced in their original form in this Appendix. If you need additional information, please refer to the appropriate Chapter or Section of these two Manuals.

REFERENCE MANUAL TABLES:

OPERATOR'S GUIDE TABLES:

TABLE 2.1
PCI-3000 I/O CONNECTIONS

PIN	NAME	FUNCTION	I/O	LIMITS	NOTE
1	AF IN	Audio from receiver	Input	10V p-p	
2	TXD	Host Port RS-232 Data Input	Input	±12 VDC	1
3	RTS	Host Port RS-232 Request-To-Send	Input	±12 VDC	1
4	SELCAL	AMTOR SEL-CAL Output	Output	+50V @ 100ma	
5	DCD	Host Port RS-232 Carrier Detect	Output	±12 VDC	1
6	SPACE	AMTOR/RTTY Tuning CRT Output	Output	10V p-p	
7	MARK	AMTOR/RTTY Tuning CRT Output	Output	10V p-p	
8	CW/RTTY	Mode switch output for SPT-2	Output	TTL (+5/GND)	
9	(n/c)	No Connection	(n/c)		
10	GND	Signal Ground	(Gnd)		2
11	FSK	AMTOR/RTTY FSK Output	Output	TTL or RS-232	4
12	GND	Signal Ground	(Gnd)		2
13	+KEY	CW Key Output (Same as pin 24)	Output	±50V @ 100ma	3
14	PTT	Transmitter Push-to-Talk Output	Output	±50V @ 100ma	
15	DTR	Host Port RS-232 Data Terminal Ready	Input	±12 VDC	1
16	RXD	Host Port RS-232 Data Output	Output	±12 VDC	1
17	CTS	Host Port RS-232 Clear-To-Send	Output	±12 VDC	1
18	AF OUT	AMTOR/RTTY Audio to Transmitter	Output	-30dBm (200mV)	
19	CWLED	CW LED Signal to SPT-2	Output	LED to GND	
20	DSR	Host Port RS-232 Data Set Ready	Output	±12 VDC	1
21	+12V	+12 VDC to SPT-2	Output	+12 V,100 ma	5
22	-12V	-12 VDC to SPT-2	Output	-12 V,100 ma	5
23	+5V	+5 VDC to SPT-2	Output	+5 V,100 ma	5
24	-KEY	CW Key Output (Same as pin 13)	Output	±50V @ 100 ma	3
25	GND	Signal Ground	(Gnd)		2

NOTES:

1. Host Port connections are discussed in Chapter 4.

2. Any or all of the GND pin connections (pins 10, 12, and 25) may be used as required. Be sure to leave one pin for Host Port connection.

3. Two CW KEY Outputs are supplied (pins 13 and 24). In the PCI-3000, a high speed relay is used for CW output to key either polarity of transmitter key line. Separate pins are provided to maintain compatibility with the PCI-EXT and SPT-1 accessories.

4. Using the FSK output requires selection of the FSK signal polarity and TTL or RS-232 levels with jumpers on the PCI-3000 circuit board. See APPENDIX C for recommended settings for various transceiver models.

5. PC power supply voltages (pins 21, 22, and 23) are provided only for use by the SPT-2. Do not attempt to use these voltages to power other accessories.

6. Be sure to run a good RF ground between the PC and your radio system!

TABLE 2.2
CONNECTIONS USING THE SPT-2

SPT-2 CONNECTOR	FUNCTION	I/O	LIMITS	TYPICAL RADIO CONN.	NOTE
AUDIO IN	Audio from Receiver	Input	10V p-p	EXT SPKR PHONE PATCH OUT	
AUDIO OUT	Audio to LSB Xmiter	Output	30mV rms	MICROPHONE IN PHONE PATCH IN	1
PTT	Push-To-Talk Signal	Output	+50V, 200ma	MICROPHONE PTT XMIT CONTROL STBY CONTROL	
FSK	FSK Transmit Data	Output	TTL/RS-232	FSK INPUT RTTY DATA IN	1
KEY	CW Transmit Key	Output	±50V, 100ma	CW KEY HAND KEY	2
SEL-CAL	SEL-CAL Signal	Output	+50V, 100ma	See APPENDIX A	3
M	MARK CRT Output	Output	10V p-p	Optional	
S	SPACE CRT Output	Output	10V p-p	Optional	
GND	RF Ground	(Gnd)	GROUND	GND	
HOST PORT	Host Port RS-232		±12 VDC	See Chapter 4	4

Notes:

1. AMTOR and RTTY may be transmitted using either "AFSK" with the transmitter in "LSB" mode or "FSK" using the "FSK Input" and "FSK Mode" if it is available on your radio equipment. Using FSK mode requires setting two jumpers on the PCI-3000 circuit board (polarity and TTL/RS-232). Refer to APPENDIX C for a discussion of FSK option selection.

2. Either positive or negative voltage CW key lines may be keyed by the PCI-3000. Be sure to choose a "hand-key" input to your transceiver and NOT a special "squeeze-key" input that may be provided on some transceivers.

3. Using the SEL-CAL output may require special modifications of your radio equipment. See APPENDIX A for more details.

4. Connection to the Host Port is discussed in detail in Chapter 4.

5. Be sure to make a good ground wire connection between the SPT-2 GND terminal and the radio RF ground system.

TABLE 3.1

FUNCTION KEYS

KEY	OPERATION
[F1]	Go to COMMAND mode
[Alt]-[F1]	Go to COMMAND mode
[Ctrl]-[F1]	Go to COMMAND mode
[F2]	Send CALL + ID (other station's call + your call)
[Alt]-[F2]	Not Used
[Ctrl]-[F2]	Change AMTOR SEL-CAL for Other Station (REMOTE CALL)
[F3]	Send CALL (other station's call sign)
[Alt]-[F3]	Not Used
[Ctrl]-[F3]	Change CALL (other station's call sign)
[F4]	Send ID (your call sign)
[Alt]-[F4]	Send ID in CW
[Ctrl]-[F4]	Not Used
[F5]	Send HERE IS 1
[Alt]-[F5]	Not Used
[Ctrl]-[F5]	Change HERE IS 1
[F6]	Send HERE IS 2
[Alt]-[F6]	Not Used
[Ctrl]-[F6]	Change HERE IS 2
[F7]	Send AMTOR OVER (insert +? in transmit buffer)
[Alt]-[F7]	Force AMTOR OVER (force OVER when you are IRS)
[Ctrl]-[F7]	Not Used
[F8]	Send AMTOR END Signal (insert "ZZZZ" in transmit buffer)
[Alt]-[F8]	Force AMTOR End ("Panic kill")
[Ctrl]-[F8]	Not Used
[F9]	Send AMTOR ARQ (Mode A)
[Alt]-[F9]	Not Used
[Ctrl]-[F9]	Not Used
[F10]	Restart SEARCH mode
[Alt]-[F10]	Transmit Buffer Enable/Disable
[Ctrl]-[F10]	Transmit Buffer Enable/Disable

TABLE 3.2
SPECIAL KEYS

KEY	OPERATION
[Alt]-A	Advance RTTY Data Rate
[Alt]-B	Insert Time and Date into Transmit Buffer
[Alt]-C	CW Receive Side-tone ON/OFF
[Alt]-D	Insert Date into Transmit Buffer
[Alt]-E	Insert WRU ANSWERBACK message in Transmit buffer
[Alt]-F	Reformat current paragraph (edit)
[Alt]-G	Printer ON/OFF Toggle
[Alt]-H	Show HELP Information
[Alt]-K	Delete Line (edit)
[Alt]-L	Force LETTER case in AMTOR & Baudot Receive
[Alt]-M	Send <<<<<<<<<<<< (12 x Baudot LTRS)
[Alt]-N	NORM/REV RTTY Polarity Toggle
[Alt]-P	Set RTTY Print Squelch
[Alt]-Q	Insert "THE QUICK BROWN FOX ..." message in TX buffer
[Alt]-R	Shift Screen Scroll Controls to Receive Buffer
[Alt]-S	CW Transmit Side-tone ON/OFF
[Alt]-T	Insert Time into Transmit Buffer
[Alt]-U	Clear Receive Buffer (NOT Recoverable!)
[Alt]-V	Clear Transmit Buffer (NOT Recoverable!)
[Alt]-W	Delete Word (edit)
[Alt]-X	Shift Screen Scroll Controls to Transmit Buffer
[Alt]-Z	Send Time/Date Group in Military format
[Shift]-[PrtSc]	Print Current Display Screen
[Esc]	Back-up One Step in Command Menus
[Left-arrow]	Move Cursor Left 1 Character (edit)
[Ctrl]-[Left]	Move Cursor Left 1 Word (edit)
[Right-arrow]	Move Cursor Right 1 Character (edit)
[Ctrl]-[Right]	Move Cursor Right 1 Word (edit)
[Up-arrow]	Move Cursor Up 1 Line (edit)
[Down-arrow]	Move Cursor Down 1 Line (edit)
[PgUp]	Move Cursor Up 1 Page (10 lines) (edit & RX Buffer)
[PgDn]	Move Cursor Down 1 Page (10 lines) (edit & RX Buffer)
[Home]	Move Cursor to Beginning of Line (edit)
[Ctrl]-[Home]	Move Cursor to Beginning of Buffer (edit & RX Buffer)
[End]	Move Cursor to End of Line (edit)
[Ctrl]-[End]	Move Cursor to End of Buffer (edit & RX Buffer)
[BS] ([Ctrl]-H)	Delete Character to Left of Cursor (edit)
[Back-arrow]	Delete Character to Left of Cursor (edit; same as BS)
[Del]	Delete Character at Cursor (edit)
[Ins]	Toggle Between INSERT and OVERTYPE Edit Modes (edit)

TABLE 3.3
MESSAGES

LABEL	USE
ID	The call sign of *your* station (DE K9GWT, for example) (16 characters maximum; include "DE" if you want it to be sent).
CALL	The call sign of the *other* station (K9CW, for example) (16 characters maximum)
HERE IS 1	A custom message you may wish to send frequently (60 characters maximum)
HERE IS 2	A custom message you may wish to send frequently (60 characters maximum)

TABLE 3.4
AMTOR CALLS

LABEL	USE
LC 476	The 4-letter ARQ SEL-CAL for *your* station (ex: KGWT) (4 letters required; *no numbers*)
LC 625	The 7-letter ARQ SEL-CAL for *your* station (ex: KIGWTXX) (7 letters required; *no numbers*)
GROUP CALL	The 4-letter SFEC SEL-CAL for *your* station (ex: CQCQ) (4 letters required; *no numbers*)
ANSWERBACK	Response message from *your* station to an ARQ WRU call. (32 characters maximum; ex: QRA K9GWT KGWT)

TABLE 3.5
CALL DIRECTORY

LABEL	USE
LAST	SEL-CAL and Call Sign of *last called other station*
RC1	SEL-CAL and Call Sign of 1st Call Directory station
RC2	SEL-CAL and Call Sign of 2nd Call Directory station
RC3	SEL-CAL and Call Sign of 3rd Call Directory station
RC4	SEL-CAL and Call Sign of 4th Call Directory station
RC5	SEL-CAL and Call Sign of 5th Call Directory station (4 or 7 letters only for SEL-CAL) (16 characters maximum for call signs)

TABLE 3.6
"HOT-KEY" MESSAGE ACCESS

"HOT-KEY"	OPERATION
[F2]	Load **CALL** plus **ID** into transmit buffer. Example: **K9CW DE K9GWT**
[Ctrl]-[F2]	Program *other station's* ARQ **SEL-CAL.** Example: **KKCW**
[F3]	Load **CALL** into transmit buffer (*his* call sign)
[Ctrl]-[F3]	Program **CALL** (*his* call sign) Example: **K9CW**
[F4]	Load **ID** into transmit buffer (*your* call sign)
[Alt]-[F4]	Load **CW ID** into transmit buffer (*your* call sign) Example: **DE K9GWT**
[F5]	Load **HERE IS 1** into transmit buffer.
[Ctrl]-[F5]	Program **HERE IS 1.** Example: **QSL UR RST 599 599 599 IN IL IL IL**
[F6]	Load **HERE IS 2** into transmit buffer.
[Ctrl]-[F6]	Program **HERE IS 2.** Example: **CQ CQ CQ DE K9GWT K9GWT KGWT KGWT**

TABLE 3.7
LOCAL STATION MESSAGE EXAMPLES
(Local Call Sign = K9GWT)

PARAMETER	CONTENTS	EXAMPLE
ID	DE [your call sign]	**DE K9GWT**
HERE IS 1	[information 1]	**DE BILL, K9GWT, URBANA, IL**
HERE IS 2	[information 2]	**QSL UR RST 599 599 599 IL IL IL**
LC 476	[4-letter ARQ SEL-CAL]	**KGWT**
LC 625	[7-letter ARQ SEL-CAL]	**KIGWTXX**
GROUP CALL	[4-letter SFEC SEL-CAL]	**CQCQ**
ANSWERBACK	[ARQ WRU response]	**QRA K9GWT KGWT**

TABLE 3.8
TRANSMIT BUFFER CONTROL KEYS

KEY	OPERATION
[Alt]-X	Set scroll key to control the transmit buffer
[left arrow]	Move cursor left one character.
[Ctrl]-[left]	Move cursor left one word.
[right arrow]	Move cursor right one character
[Ctrl]-[right]	Move cursor right one word
[up arrow]	Move cursor up one line
[down arrow]	Move cursor down one line
[PgUp]	Move cursor up ten lines (one screen)
[PgDn]	Move cursor down ten lines (one screen)
[Home]	Move cursor to beginning of line
[Ctrl]-[Home]	Move cursor to line 1, column 1
[End]	Move cursor to end of line
[Ctrl]-[End]	Move cursor to last text line of transmit buffer
BS ([Ctrl]-H)	Delete character to left of cursor
[Back arrow]	Delete character to left of cursor
[Del]	Delete character at cursor
[Ins]	Toggle between INSERT and OVERTYPE modes
[Alt]-F	Reformat current paragraph
[Alt]-K	Delete line
[Alt]-W	Delete word
[Alt]-V	Clear Entire Transmit buffer

TABLE 4.1
PCI-3000 HOST PORT CONNECTIONS

PIN	NAME	FUNCTION	I/O	LIMITS	NOTE
2	TXD	Host Port RS-232 Data Input	Input	±12 VDC	
3	RTS	Host Port RS-232 Request-To-Send	Input	±12 VDC	
4	SEL-CAL	SEL-CAL Output	Output	50V, 100ma	
5	DCD	Host Port RS-232 Carrier Detect	Output	±12 VDC	
10	GND	Signal Ground	(Gnd)		1
12	GND	Signal Ground	(Gnd)		1
15	DTR	Host Port RS-232 Data Terminal Ready	Input	±12 VDC	
16	RXD	Host Port RS-232 Data Output	Output	±12 VDC	
17	CTS	Host Port RS-232 Clear-To-Send	Output	±12 VDC	
20	DSR	Host Port RS-232 Data Set Ready	Output	±12 VDC	
25	GND	Signal Ground	(Gnd)		1

NOTES:

1. Host Port may use any of the three ground connections (pins 10, 12, or 25). Be sure to leave adequate ground connections to the radio.

2. PC power supply voltages are on pins 21, 22, and 23 to power the SPT-2. Be very careful to avoid shorting any of these pins.

TABLE 4.2
SPT-2 HOST PORT CONNECTIONS

PIN	NAME	FUNCTION	I/O	LIMITS	NOTE
1	GND	Chassis Ground	(Gnd)		2
2	TXD	Host Port RS-232 Data Input	Input	±12 VDC	
3	RXD	Host Port RS-232 Data Output	Output	±12 VDC	
4	RTS	Host Port RS-232 Request-To-Send	Input	±12 VDC	
5	CTS	Host Port RS-232 Clear-To-Send	Output	±12 VDC	
6	DSR	Host Port RS-232 Data Set Ready	Output	+12 VDC	
7	GND	Signal Ground	(Gnd)		2
8	DCD	Host Port RS-232 Carrier Detect	Output	±12 VDC	
20	DTR	Host Port RS-232 Data Terminal Ready	Input	±12 VDC	

NOTES:
1. All other DB-25 pins are no connection.
2. Connect Signal ground to pin 7 and cable shield to pin 1
3. The Host Port DB-25S is a DCE device.

TABLE 4.3
HOST MODE COMMANDS

HOST MODE COMMAND		DESCRIPTION
[Esc]-A		Enter AMTOR Standby mode
[Esc]-B		Set RTTY Baud Rate: 45, 50, 57, 75, or "00" for 110 2nd digit ends entry
[Esc]-C		Enter CW mode
[Esc]-D	1	Enter ASCII mode, Baud = 110
[Esc]-I		Set own SEL-CAL (4 letters); 4th char. ends entry.
[Esc]-L		Echo switch: [ESC]-L 0 to disable.
[Esc]-N		Auto newline control: [Esc]-N 1 Enables, 0 disables
[Esc]-P	2	Set SEL-CALL output mode (0 = continuous, 1 = pulsed)
[Esc]-Q		Output terminal values (see Table 4.4)
[Esc]-R		Select RTTY (Baudot) mode
[Esc]-S		Set CW speed in WPM; 05 - 50 = WPM speed
[Esc]-T		Set time-out during phasing: 01 = OFF; 00 & 02-99 = ON
[Esc]-U	2	Set CD (Control Delay; 2 digits; 05 - 99; greater than TD)
[Esc]-V	2	Set TD (Transmit Delay; 2 digits; 05 - 99; less than CD)
[Crtl]-A		RTTY: go to transmit AMTOR: specify 4-letter outgoing SEL-CAL and xmit in ARQ mode. CW: go to transmit
[Ctrl]-B		RTTY: go to transmit AMTOR: start FEC transmission. CW: go to transmit
[Ctrl]-C		RTTY: switch from TX to RX AMTOR: ARQ "Over" FEC - no effect CW: go to receive
[Crtl]-D		RTTY: switch from TX to RX AMTOR: FEC - send end code ARQ - send end but only when ISS. LISTEN: end listen mode, go to STBY CW: go to receive
[Ctrl]-E		Send status character to terminal (see Table 4.5)
[Ctrl]-F		RTTY: no effect AMTOR: enable LISTEN mode; must be in AMTOR mode first ([Esc]-A)
[Ctrl]-G		RTTY & AMTOR: send bell CW: no effect
[Ctrl]-S	2	Enter ESCape mode (for manual control within APLink)
[Ctrl]-X		Clear transmit buffer; will also clear any pending CTRL-D.
[Del]		RTTY & AMTOR: force receive LTRS shift CW: no effect
[CR], [LF], [Null]		Treated as text and passed to xmtr; next non-[Ctrl] char. will include FIGS or LTRS as indicated.

NOTES:

1 = ASCII mode cannot transmit [Esc] or any control characters used in the above command set.

2 = New commands, additional to those of the AMT-1

TABLE 4.4
[Esc]-Q Terminal Value Response Example

Example Return: "V:01 I:???? T:30 B:45 S:20 L:1 N:1"
V.01 = firmware version number

I:[own SEL-CAL]	S:20 = CW Speed (20 wpm)
T:30 = Timeout (30 sec)	L:1 = Echo ON (0 = OFF)
B:45 = Baud Rate (45 bd)	N:1 = Auto New Line ON

TABLE 4.5
[Ctrl]-E Status Character Bit Construction

Bit Number								
7	6	5	4	3	2	1	0	Status Condition
1	.	.	.	.	0	0	0	Error
1	.	.	.	.	0	0	1	RQ
1	.	.	.	.	0	1	0	Traffic
1	.	.	.	.	0	1	1	Idle
1	.	.	.	.	1	0	0	Over
1	.	.	.	.	1	0	1	Phase
1	.	.	.	.	1	1	0	STBY
1	.	.	.	.	1	1	1	ESC
1	.	.	.	0	.	.	.	Not SEND
1	.	.	.	1	.	.	.	SEND
1	.	0	0	.	.	.	.	ARQ Mode
1	.	0	1	.	.	.	.	FEC Mode
1	.	1	0	.	.	.	.	RTTY Mode
1	.	1	1	.	.	.	.	CW Mode
1	0	.	.	.	.	.	.	Buffer Empty
1	1	.	.	.	.	.	.	Buffer Not Empty

TABLE APB.1
PCI-3000 I/O BASE ADDRESS SELECTION

SWITCH S1							SWITCH S1						
1	2	3	4	5	6	BASE ADDRESS	1	2	3	4	5	6	BASE ADDRESS
C	C	C	C	C	C	N/A	O	C	C	C	C	C	300H
C	C	C	C	C	O	N/A	O	C	C	C	C	O	308H
C	C	C	C	O	C	210H	O	C	C	C	O	C	310H
C	C	C	C	O	O	218H	O	C	C	C	O	O	318H
C	C	C	O	C	C	N/A	O	C	C	O	C	C	N/A
C	C	C	O	C	O	N/A	O	C	C	O	C	O	N/A
C	C	C	O	O	C	N/A	O	C	C	O	O	C	330H
C	C	C	O	O	O	N/A	O	C	C	O	O	O	338H
C	C	O	C	C	C	240H	O	C	O	C	C	C	340H
C	C	O	C	C	O	248H	O	C	O	C	C	O	348H
C	C	O	C	O	C	250H	O	C	O	C	O	C	350H
C	C	O	C	O	O	258H	O	C	O	C	O	O	358H
C	C	O	O	C	C	260H **	O	C	O	O	C	C	360H
C	C	O	O	C	O	268H	O	C	O	O	C	O	368H
C	C	O	O	O	C	270H	O	C	O	O	O	C	370H
C	C	O	O	O	O	N/A	O	C	O	O	O	O	N/A
C	O	C	C	C	C	280H	O	O	C	C	C	C	380H
C	O	C	C	C	O	288H	O	O	C	C	C	O	388H
C	O	C	C	O	C	290H	O	O	C	C	O	C	390H
C	O	C	C	O	O	298H	O	O	C	C	O	O	398H
C	O	C	O	C	C	2A0H	O	O	C	O	C	C	3A0H
C	O	C	O	C	O	2A8H	O	O	C	O	C	O	3A8H
C	O	C	O	O	C	2B0H	O	O	C	O	O	C	N/A
C	O	C	O	O	O	2B8H	O	O	C	O	O	O	N/A
C	O	O	C	C	C	2C0H	O	O	O	C	C	C	N/A
C	O	O	C	C	O	2C8H	O	O	O	C	C	O	N/A
C	O	O	C	O	C	2D0H	O	O	O	C	O	C	N/A
C	O	O	C	O	O	2D8H	O	O	O	C	O	O	N/A
C	O	O	O	C	C	2E0H	O	O	O	O	C	C	N/A
C	O	O	O	C	O	2E8H	O	O	O	O	C	O	3E8H
C	O	O	O	O	C	N/A	O	O	O	O	O	C	N/A
C	O	O	O	O	O	N/A	O	O	O	O	O	O	N/A

NOTE: (C) = Switch CLOSED or ON
(O) = Switch OPEN or OFF
N/A = NOT AVAILABLE; do not use.
** = Factory Default Address (260H)

TABLE APB.2
PC-XT and PC-AT I/O ADDRESS ASSIGNMENTS

	BASE	DESCRIPTION
	200H	Game Port
	208H	Game Port
+	210H	PC Expansion Unit
+	218H	(not assigned)
	220H	"Reserved"
	228H	"Reserved"
	230H	"Reserved"
	238H	"Reserved"
+	240H	Clock Card (Primary)
+	248H	Clock Card (Primary)
+	250H	Clock Card (Primary)
+	258H	Clock Card (Primary)
+	260H **	(not assigned)
+	268H	(not assigned)
+	270H	(not assigned)
	278H	Printer (LPT2)
+	280H	ARCNET LAN Card
+	288H	(not assigned)
+	290H	(not assigned)
+	298H	(not assigned)
+	2A0H	(not assigned)
+	2A8H	(not assigned)
+	2B0H	Alternate EGA
+	2B8H	(not assigned)
+	2C0H	Clock Card (AST)
+	2C8H	Clock Card (AST)
+	2D0H	Clock Card (AST)
+	2D8H	Clock Card (AST)
+	2E0H	ARCNET LAN Card
+	2E8H	(not assigned)
	2F0H	"Reserved"
	2F8H	Async Port (COM2)

	BASE	DESCRIPTION
+	300H	"Prototype Card"
+	308H	"Prototype Card"
+	310H	"Prototype Card"
+	318H	"Prototype Card"
	320H	Fixed Disk
	328H	Fixed Disk
+	330H	(not assigned)
+	338H	(not assigned)
+	340H	Clock Card (Secondary)
+	348H	Clock Card (Secondary)
+	350H	Clock Card (Secondary)
+	358H	Clock Card (Secondary)
+	360H	PC Network (PC-AT)
+	368H	PC Network (PC-AT)
+	370H	(not assigned)
	378H	Printer (LPT1)
+	380H	Sync Port (Secondary)
+	388H	Sync Port (Secondary)
+	390H	PC Cluster (PC-AT)
+	398H	(not assigned)
+	3A0H	Sync Port (Primary)
+	3A8H	Sync Port (Primary)
	3B0H	Monochrome Display Adapter
	3B8H	Monochrome Display Adapter
	3C0H	"Reserved"
	3C8H	"Reserved"
	3D0H	Color Graphics Adapter
	3D8H	Color Graphics Adapter
	3E0H	"Reserved"
+	3E8H	(not assigned)
	3F0H	Disk Controller
	3F8H	Async Port (COM1)

NOTE: (+) indicates available PCI-3000 I/O base addresses.
** = Factory Default PCI-3000 Address (260H)
The Above Board "MEGAPAGE" card may use address 0260H. If conflicts are found, try setting the PCI-3000 to address **0330H**.

TABLE APC.1
PCI-3000 FSK OUTPUT OPTIONS

POLARITY (J4)	LEVEL (J2)	MARK	SPACE
NORM	TTL	< 1.2V	> 3.5V
REV	TTL	> 3.5V	< 1.2V
NORM	RS232	- 8V	+ 8V
REV	RS232	+ 8V	- 8V

TABLE APC.2
FSK FOR TYPICAL AMATEUR TRANSCEIVERS

MFGR	MODEL	POLARITY (J4)	LEVEL (J2)
TEN-TEC	CORSAIR	NORM	RS232
TEN-TEC	PARAGON (585)	NORM	RS232
TEN-TEC	OMNI V (562)	NORM	RS232
KENWOOD	TS-180	NORM	TTL
KENWOOD	TS-440	NORM	RS232
KENWOOD	TS-930s	REV	TTL
KENWOOD	TS-940s	NORM	RS232 or TTL
ICOM	IC-730	REV	TTL
ICOM	IC-740	REV	TTL
ICOM	IC-745	REV	TTL
ICOM	IC-751	REV	TTL
ICOM	IC-761	REV	TTL
ICOM	IC-781	REV	TTL
YAESU	FT-101ZD	NORM	TTL
YAESU	FT-107	NORM	TTL
YAESU	FT-910/902	NORM	TTL
YAESU	FT-980	NORM	TTL
YAESU	FT-ONE	NORM	TTL

TABLE B.1
RECEIVE DISPLAY CONTROL KEYS

KEY	FUNCTION
[Alt]-R	Set scroll key to control the receive buffer
[up arrow]	Scroll up one line
[down arrow]	Scroll down one line
[PgUp]	Scroll up ten lines (one screen)
[PgDn]	Scroll down ten lines (one screen)
[Ctrl]-[Home]	Scroll to show last received ten lines
[Ctrl]-[End]	Scroll to show earliest received ten lines
[Alt]-U	Clear Entire Receive buffer

BE CAREFUL ABOUT [Alt]-U! It clears the entire 250 line receive buffer. Once deleted, the text is not recoverable!

TABLE B.2
TX/RX CONTROL STATES ([Alt]-[F10])

STATE	FUNCTION
RX DIS	Receiving text. Typed text will not be transmitted
RX EN	Receiving text, but newly typed text will interrupt reception and be immediately transmitted.
TX ACT	Actively transmitting text

The state of transmit output is switched by typing the [Alt]-[F10] keys.

NOTE: Text cannot be typed into the transmit buffer when you are in COMMAND mode. However, if you have pre-typed text, start sending, and then enter COMMAND mode, the pre-typed text will continue transmitting.

TABLE B.3
TRANSMIT BUFFER CONTROL KEYS

KEY	OPERATION
[Alt]-X	Set scroll key to control the transmit buffer
[left arrow]	Move cursor left one character.
[Ctrl]-[left]	Move cursor left one word.
[right arrow]	Move cursor right one character
[Ctrl]-[right]	Move cursor right one word
[up arrow]	Move cursor up one line
[down arrow]	Move cursor down one line
[PgUp]	Move cursor up ten lines (one screen)
[PgDn]	Move cursor down ten lines (one screen)
[Home]	Move cursor to beginning of line
[Ctrl]-[Home]	Move cursor to line 1, column 1
[End]	Move cursor to end of line
[Ctrl]-[End]	Move cursor to last text line of transmit buffer
BS ([Ctrl]-H)	Delete character to left of cursor
[Back arrow]	Delete character to left of cursor
[Del]	Delete character at cursor
[Ins]	Toggle between INSERT and OVERTYPE modes
[Alt]-F	Reformat current paragraph
[Alt]-K	Delete line
[Alt]-W	Delete word
[Alt]-V	Clear Entire Transmit buffer

BE CAREFUL ABOUT [Alt]-V! It clears the entire 250 line transmit buffer. Once deleted, text is not recoverable!

TABLE C.1
MESSAGES

LABEL	USE
ID	The call sign of *your* station (DE K9GWT, for example) (16 characters maximum; include "DE" if you want it to be sent).
CALL	The call sign of the *other* station (K9CW, for example) (16 characters maximum)
HERE IS 1	A custom message you may wish to send frequently (60 characters maximum)
HERE IS 2	A custom message you may wish to send frequently (60 characters maximum)

TABLE C.2
AMTOR CALLS

LABEL	USE
LC 476	The 4-letter ARQ SEL-CAL for *your* station (ex: KGWT) (4 letters required; *no numbers*)
LC 625	The 7-letter ARQ SEL-CAL for *your* station (ex: KIGWTXX) (7 letters required; *no numbers*)
GROUP CALL	The 4-letter SFEC SEL-CAL for *your* station (ex: CQCQ) (4 letters required; *no numbers*)
ANSWERBACK	Response message from *your* station to an ARQ WRU call. (32 characters maximum; ex: QRA K9GWT KGWT)

TABLE C.3
CALL DIRECTORY

LABEL	USE
LAST	SEL-CAL and Call Sign of *last called other station*
RC1	SEL-CAL and Call Sign of 1st Call Directory station
RC2	SEL-CAL and Call Sign of 2nd Call Directory station
RC3	SEL-CAL and Call Sign of 3rd Call Directory station
RC4	SEL-CAL and Call Sign of 4th Call Directory station
RC5	SEL-CAL and Call Sign of 5th Call Directory station (4 or 7 letters only for SEL-CAL) (16 characters maximum for call signs)

TABLE C.4
"HOT-KEY" MESSAGE ACCESS

"HOT-KEY"	OPERATION
[F2]	Load **CALL** plus **ID** into transmit buffer. Example: **K9CW DE K9GWT**
[Ctrl]-[F2]	Program *other station's* ARQ **SEL-CAL.** Example: **KKCW**
[F3]	Load **CALL** into transmit buffer (*his* call sign)
[Ctrl]-[F3]	Program **CALL** (*his* call sign) Example: **K9CW**
[F4]	Load **ID** into transmit buffer (*your* call sign)
[Alt]-[F4]	Load **CW ID** into transmit buffer (*your* call sign) Example: **DE K9GWT**
[F5]	Load **HERE IS 1** into transmit buffer.
[Ctrl]-[F5]	Program **HERE IS 1.** Example: **QSL UR RST 599 599 599 IN IL IL IL**
[F6]	Load **HERE IS 2** into transmit buffer.
[Ctrl]-[F6]	Program **HERE IS 2.** Example: **CQ CQ CQ DE K9GWT K9GWT KGWT KGWT**

TABLE C.5
LOCAL STATION MESSAGE EXAMPLES
(Local Call Sign = K9GWT)

PARAMETER	CONTENTS	EXAMPLE
ID	DE [your call sign]	**DE K9GWT**
HERE IS 1	[information 1]	**DE BILL, K9GWT, URBANA, IL**
HERE IS 2	[information 2]	**QSL UR RST 599 599 599 IL IL IL**
LC 476	[4-letter ARQ SEL-CAL]	**KGWT**
LC 625	[7-letter ARQ SEL-CAL]	**KIGWTXX**
GROUP CALL	[4-letter SFEC SEL-CAL]	**CQCQ**
ANSWERBACK	[ARQ WRU response]	**QRA K9GWT KGWT**

TABLE E.1
RTTY DATA RATES AND SPEEDS

CODE	BAUD	WPM	COMMENTS
BAUDOT	45	60	"Standard" Baudot Speed
BAUDOT	50	66	"European" Baudot Speed
BAUDOT	57	75	"Weather" Baudot Speed
BAUDOT	74	100	Most Baudot "Mailboxes"
BAUDOT	110	137.5	Non-standard Speed
ASCII	45	41	Non-standard Speed
ASCII	50	45	Non-standard Speed
ASCII	57	52	Non-standard Speed
ASCII	74	67	Non-standard Speed
ASCII	110	100	"Standard" ASCII Speed

TABLE E.2
U.S. vs CCITT No. 2 BAUDOT

CODE	U.S. Baudot	CCITT No. 2 in PC-AMTOR
FIGS-D	$ (dollar sign)	$ (dollar sign)
FIGS-H	# (number sign)	(number sign)
FIGS-J	' (apostrophe)	BELL
FIGS-S	BELL	' (apostrophe)
FIGS-V	; (semi-colon)	= (equal sign)
FIGS-Z	" (quotation)	+ (plus sign)

TABLE E.3
SPECIAL RTTY TRANSMIT KEYS

KEY	CHARACTER	NOTES
[Ctrl]-G	Signal Bell	"Diamond" symbol on screen
<	LTRS	Only Baudot and AMTOR
>	FIGS	Only Baudot and AMTOR
[Alt]-M	12 LTRS	Sequence of 12 LTRS

TABLE F.1
CW RECEIVE CHARACTER SET

LETTER	CODE	DISPLAYED
A	*-	A
B	-***	B
C	-*-*	C
D	-**	D
E	*	E
F	**-*	F
G	--*	G
H	****	H
I	**	I
J	*---	J
K	-*-	K
L	**-*	L
M	--	M
N	-*	N
O	---	O
P	*--*	P
Q	--*-	Q
R	*-*	R
S	***	S
T	-	T
U	**-	U
V	***-	V
W	*--	W
X	-**-	X
Y	-*--	Y
Z	--**	Z
1	*----	1
2	**---	2
3	***--	3
4	****-	4
5	*****	5
6	-****	6
7	--***	7
8	---**	8
9	----*	9
0	-----	0

SYMBOLS/PROSIGNS	CODE	DISPLAYED
PUNCTUATION:		
(slash)	-**-*	/
(period)	*-*-*-	.
(comma)	--**--	,
(query)	**--**	?
(colon)	---***	:
(semi-colon)	-*-*-*	;
(paren)	-*--*-	)
(quote)	*-**-*	"
(dollar)	***-**-	$
(apostrophe)	*----*	'
(underline)	**--*-	
(error)	********	{********}
	(6 or more dots)	
PROSIGNS:		
AA (all after)	*-*-	aa
AR (end of message)	*-*-*	ar
AS (wait)	*-***	as
BT (pause)	-***-	bt
KA (start of message)	-*-*-	ka
KN (restricted over)	-*--*	kn
SN (understood)	***-*	sn
SK (end of QSO)	***-*-	sk
SPECIAL CHARACTERS		
a	*--*-	a
e	**-**	e
n	--*--	n
o	---*	o
s	----	s
u	**--	u
z	--**-	z

TABLE F.2
CW TRANSMIT KEYS FOR PROSIGNS AND SPECIAL CHARACTERS

PROSIGN	CODE	DISPLAY	KEY COMBINATION
AA (all after)	*-*-	aa	<
AR (end of message)	*-*-*	ar	+
AS (wait)	*-***	as	>
BT (pause)	-***-	bt	=
KA (start of message)	-*-*-	ka	@
KN (restricted over)	-*--*	kn	(
SN (understood)	***-*	sn	#
SK (end of QSO)	***-*-	sk	*
(error)	******** (8 dots)	{********}	!

SPECIAL CHARACTERS:

a	*--*-	a	Ctrl-A
c	-*-**	c	Ctrl-C
e	**-**	e	Ctrl-E
n	--*--	n	Ctrl-N
o	---*	o	Ctrl-O
s	----	s	Ctrl-S
u	**--	u	Ctrl-U
z	--**-	z	Ctrl-Z

TABLE G.1
AUTO SEARCH COMBINATIONS

DATA RATE	DATA TYPE	FRAME	FORMAT	CODE/MODE
110 Baud	Asynchronous	8 bits	Continuous	ASCII RTTY
100 Baud	Synchronous	7 bits	Pulsed	AMTOR ARQ
100 Baud	Synchronous	7 bits	Continuous	AMTOR FEC
100 Baud	Synchronous	7 bits	Continuous	AMTOR SEL-FEC
74 Baud	Asynchronous	5 Bits	Continuous	BAUDOT RTTY
57 Baud	Asynchronous	5 Bits	Continuous	BAUDOT RTTY
50 Baud	Asynchronous	5 Bits	Continuous	BAUDOT RTTY
45 Baud	Asynchronous	5 Bits	Continuous	BAUDOT RTTY
5-50 Baud	ON/OFF	none	Pulsed	CW

APPENDIX B
I/O ADDRESS SELECTION

The PCI-3000 circuit board includes a unique bus interface for communications with the host personal computer. Rather than using a PC address (and interrupt) that may already be assigned to another device, the PCI-3000 uses I/O mapped port addressing. The PCI-3000 does not use any of the PC's standard hardware interrupts. Instead, the PC-AMTOR software "polls" the PCI-3000 I/O addresses. As a result, major conflicts are avoided with serial I/O ports, printer ports, and other devices that may also be installed in the PC.

Circuit board DIP switch S1 may be set to a wide range of I/O base addresses. Thus, even if another PC accessory card uses the PCI-3000 factory default I/O address, the PCI-3000 may be moved to another, non-conflicting location.

All PCI-3000 circuit boards are set to I/O base address **260H** when shipped from the factory. If you have a conflict, this address may be changed by simply changing the setting of DIP switch S1. PC-AMTOR automatically checks to make sure that the PCI-3000 address is correct. If not, PC-AMTOR then checks all available locations and adjusts to the new I/O base address.

Available I/O memory addresses and S1 settings are shown below in Table APB.1.

TABLE APB.1
PCI-3000 I/O BASE ADDRESS SELECTION

SWITCH S1							SWITCH S1						
1	2	3	4	5	6	BASE ADDRESS	1	2	3	4	5	6	BASE ADDRESS
C	C	C	C	C	C	N/A	O	C	C	C	C	C	300H
C	C	C	C	C	O	N/A	O	C	C	C	C	O	308H
C	C	C	C	O	C	210H	O	C	C	C	O	C	310H
C	C	C	C	O	O	218H	O	C	C	C	O	O	318H
C	C	C	O	C	C	N/A	O	C	C	O	C	C	N/A
C	C	C	O	C	O	N/A	O	C	C	O	C	O	N/A
C	C	C	O	O	C	N/A	O	C	C	O	O	C	330H
C	C	C	O	O	O	N/A	O	C	C	O	O	O	338H
C	C	O	C	C	C	240H	O	C	O	C	C	C	340H
C	C	O	C	C	O	248H	O	C	O	C	C	O	348H
C	C	O	C	O	C	250H	O	C	O	C	O	C	350H
C	C	O	C	O	O	258H	O	C	O	C	O	O	358H
C	C	O	O	C	C	260H **	O	C	O	O	C	C	360H
C	C	O	O	C	O	268H	O	C	O	O	C	O	368H
C	C	O	O	O	C	270H	O	C	O	O	O	C	370H
C	C	O	O	O	O	N/A	O	C	O	O	O	O	N/A
C	O	C	C	C	C	280H	O	O	C	C	C	C	380H
C	O	C	C	C	O	288H	O	O	C	C	C	O	388H
C	O	C	C	O	C	290H	O	O	C	C	O	C	390H
C	O	C	C	O	O	298H	O	O	C	C	O	O	398H
C	O	C	O	C	C	2A0H	O	O	C	O	C	C	3A0H
C	O	C	O	C	O	2A8H	O	O	C	O	C	O	3A8H
C	O	C	O	O	C	2B0H	O	O	C	O	O	C	N/A
C	O	C	O	O	O	2B8H	O	O	C	O	O	O	N/A
C	O	O	C	C	C	2C0H	O	O	O	C	C	C	N/A
C	O	O	C	C	O	2C8H	O	O	O	C	C	O	N/A
C	O	O	C	O	C	2D0H	O	O	O	C	O	C	N/A
C	O	O	C	O	O	2D8H	O	O	O	C	O	O	N/A
C	O	O	O	C	C	2E0H	O	O	O	O	C	C	N/A
C	O	O	O	C	O	2E8H	O	O	O	O	C	O	3E8H
C	O	O	O	O	C	N/A	O	O	O	O	O	C	N/A
C	O	O	O	O	O	N/A	O	O	O	O	O	O	N/A

NOTE: (C) = Switch CLOSED or ON
(O) = Switch OPEN or OFF
N/A = NOT AVAILABLE; do not use.
** = Factory Default Address (260H)

Various other devices may use PC I/O addresses within the available range of the PCI-3000. As of this date, Table APB.2 lists those PC accessory devices known to HAL and their I/O address requirements. We suggest that you avoid any address where there may be a conflict within your PC system.

TABLE APB.2
PC-XT and PC-AT I/O ADDRESS ASSIGNMENTS

	BASE	DESCRIPTION		BASE	DESCRIPTION
	200H	Game Port	+	300H	"Prototype Card"
	208H	Game Port	+	308H	"Prototype Card"
+	210H	PC Expansion Unit	+	310H	"Prototype Card"
+	218H	(not assigned)	+	318H	"Prototype Card"
	220H	"Reserved"		320H	Fixed Disk
	228H	"Reserved"		328H	Fixed Disk
	230H	"Reserved"	+	330H	(not assigned)
	238H	"Reserved"	+	338H	(not assigned)
+	240H	Clock Card (Primary)	+	340H	Clock Card (Secondary)
+	248H	Clock Card (Primary)	+	348H	Clock Card (Secondary)
+	250H	Clock Card (Primary)	+	350H	Clock Card (Secondary)
+	258H	Clock Card (Primary)	+	358H	Clock Card (Secondary)
+	260H **	(not assigned)	+	360H	PC Network (PC-AT)
+	268H	(not assigned)	+	368H	PC Network (PC-AT)
+	270H	(not assigned)	+	370H	(not assigned)
	278H	Printer (LPT2)		378H	Printer (LPT1)
+	280H	ARCNET LAN Card	+	380H	Sync Port (Secondary)
+	288H	(not assigned)	+	388H	Sync Port (Secondary)
+	290H	(not assigned)	+	390H	PC Cluster (PC-AT)
+	298H	(not assigned)	+	398H	(not assigned)
+	2A0H	(not assigned)	+	3A0H	Sync Port (Primary)
+	2A8H	(not assigned)	+	3A8H	Sync Port (Primary)
+	2B0H	Alternate EGA		3B0H	Monochrome Display Adapter
+	2B8H	(not assigned)		3B8H	Monochrome Display Adapter
+	2C0H	Clock Card (AST)		3C0H	"Reserved"
+	2C8H	Clock Card (AST)		3C8H	"Reserved"
+	2D0H	Clock Card (AST)		3D0H	Color Graphics Adapter
+	2D8H	Clock Card (AST)		3D8H	Color Graphics Adapter
+	2E0H	ARCNET LAN Card		3E0H	"Reserved"
+	2E8H	(not assigned)	+	3E8H	(not assigned)
	2F0H	"Reserved"		3F0H	Disk Controller
	2F8H	Async Port (COM2)		3F8H	Async Port (COM1)

NOTE: (+) indicates available PCI-3000 I/O base addresses.
** = Factory Default PCI-3000 Address (260H)

The Above Board "MEGAPAGE" card may use address 0260H. If conflicts are found, try setting the PCI-3000 to address **0330H**.

APPENDIX C
FSK OPTION SELECTION

The PCI-3000 FSK output circuit may be used with modern transceivers that include an FSK input to transmit AMTOR and RTTY. At this printing, a "universal" FSK interface standard does not exist between manufacturers or models of transceivers. Based on our previous experience with using FSK inputs, HAL has provided four interface options that will work with current equipment. If you have additional information regarding FSK inputs, we would be pleased to know of it.

The PCI-3000 FSK output is connected to J3, pin 11, as shown in Table 2.1. As noted in Chapter 2, it is much simpler to use the SPT-2 SPECTRA-TUNE accessory when connecting to your radio. The SPT-2 includes a separate RCA-type phono jack for the FSK output (Table 2.2).

Two circuit board jumper plugs allow setting of FSK polarity and voltage level. These jumpers are shown in schematic diagram of Figure 5.10, and on the parts layout diagram in Figure 5.13.

The FSK output is a data signal - not an audio signal. Jumper J2 (near the rear panel) may be set for "TTL" or "RS232" voltage levels. Jumper J4 (lower edge of circuit board) sets polarity - "NORM" or "REV". The combinations of J2 and J4 and the resulting Mark and Space transmit data voltages are shown below in Table APC.1

TABLE APC.1
PCI-3000 FSK OUTPUT OPTIONS

POLARITY (J4)	LEVEL (J2)	MARK	SPACE
NORM	TTL	< 1.2V	> 3.5V
REV	TTL	> 3.5V	< 1.2V
NORM	RS232	- 8V	+ 8V
REV	RS232	+ 8V	- 8V

A careful reading of your transceiver manual or a call to the manufacturer's "Customer Assistance Department" may be required to determine which interface level is required for your equipment.

Table APC.2 lists the correct FSK combinations for a few transceivers. This data is based on reports from HAL customers. HAL would like to know of any other information you may have concerning FSK inputs.

TABLE APC.2
FSK FOR TYPICAL AMATEUR TRANSCEIVERS

MFGR	MODEL	POLARITY (J4)	LEVEL (J2)
TEN-TEC	CORSAIR	NORM	RS232
TEN-TEC	PARAGON (585)	NORM	RS232
TEN-TEC	OMNI V (562)	NORM	RS232
KENWOOD	TS-180	NORM	TTL
KENWOOD	TS-440	NORM	RS232
KENWOOD	TS-930s	REV	TTL
KENWOOD	TS-940s	NORM	RS232 or TTL
ICOM	IC-730	REV	TTL
ICOM	IC-740	REV	TTL
ICOM	IC-745	REV	TTL
ICOM	IC-751	REV	TTL
ICOM	IC-761	REV	TTL
ICOM	IC-781	REV	TTL
YAESU	FT-101ZD	NORM	TTL
YAESU	FT-107	NORM	TTL
YAESU	FT-910/902	NORM	TTL
YAESU	FT-980	NORM	TTL
YAESU	FT-ONE	NORM	TTL

These are all of the transceiver FSK connections we know of at this writing. This table reflects a collection of data given to HAL by our customers and the manufacturers. We at HAL have not personally verified each of the above listings, but they are offered as a guide. If you have additional information regarding these or other transceiver models, HAL would appreciate your input.

If your transceiver is not listed or you have some doubts about the required level or polarity, try the following:

1. Start with NORM (J4) and TTL (J2).
2. Try sending FSK to a friend with a working RTTY station.
3. If you cannot send Mark/Space RTTY, the LEVEL (J2) may be wrong. Try LEVEL (J2) = RS232.
4. If you can send FSK, but it is upside down, change J4 to REV.

NOTE:

The above information is offered as a service to our amateur customers only. HAL cannot guarantee performance for FSK mode performance. HAL cannot be held responsible for any damage that may result from connection of voltages to a transceiver "FSK" input jack. If you have any doubts, please contact the transceiver manufacturer <u>first</u> - before making any connections.

FSK vs "AFSK" in AMTOR ARQ Mode:

PC-AMTOR and the PCI-3000 may be used in AMTOR or RTTY using "AFSK" tones into a LSB transmitter or using the FSK input and FSK mode if it is available. You may, however, notice a slight difference in AMTOR ARQ mode transmit/receive switching performance.

When "AFSK" tones are used with a LSB transmitter, HAL has included short additional delays to be sure that "hot switching" of the transmitter cannot occur. The delay sequence when using "AFSK" tones in LSB mode are:

For each ARQ mode transmitter pulse:

1. Set PTT to TX state
2. Delay 5 ms
3. Turn AFSK tones ON (TX RF output turns ON)
4. Delay by "TD" (10 ms recommended; set in CONFIGURATION menu)
5. Start sending transmit data

At the end of transmit data

6. Turn AFSK tone OFF (TX RF output turns OFF)
7. Delay 5 ms
8. Set PTT to RX state

Thus, when AFSK tones are used, the transmitter PTT line is always switched at times when there is no audio drive and therefore no transmit RF output.

Conversely, the FSK mode and input on transceivers does not allow this additional delay between PTT switching and transmitter RF output. In FSK mode, the transmitter generates RF output for as long as the PTT line is held in the TX ON state. The transceiver manufacturer may have included internal delays to prevent "hot switching" in FSK mode, but it is a feature that HAL cannot provide when FSK mode is used.

"Hot-switching" may result in:

1. ON / OFF "key clicks" on frequencies near your transmitted frequency.

2. Loss of part of the transmit data pulse - frequent loss of link or errors on otherwise strong signals.

3. Reduced life of transmit/receive relays - or destruction of relay contacts.

"Hot-switching" can be particularly destructive if you also use a linear in AMTOR ARQ mode. It is our suggestion that a linear amplifier is rarely necessary for good AMTOR ARQ performance and the risks far out-weigh the potential gain!

INDEX FOR PC-AMTOR AND PCI-3000 MANUALS

PC-AMTOR

OPERATOR'S GUIDE

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QUALITY COMMUNICATIONS EQUIPMENT

PC-AMTOR

OPERATOR'S GUIDE

870-03001

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PC-AMTOR OPERATOR'S GUIDE

CONTENTS:

CONTENTS (Continued):

TABLES:

FIGURES:

PC-AMTOR OPERATOR'S GUIDE

This guide is limited to detailed descriptions of on-the-air operation of PC-AMTOR. Section A discusses Key selection, Commands, and Menus, Section B - Screen Buffers, and Section C - Call Signs and Messages. AMTOR, RTTY, and CW are then discussed in Sections D, E, and F, respectively. AUTO SEARCH receive mode is discussed in Section G. More detailed information may be found in the PC-AMTOR REFERENCE MANUAL. The appropriate REFERENCE MANUAL sections will be indicated. *Consult the master INDEX at the end of the REFERENCE MANUAL to locate information in both manuals.*

A. BASIC OPERATION

A.1 Keystrokes and Nomenclature

When PC-AMTOR software runs in your personal computer, it uses the standard "IBM-Compatible" keyboard. Keyboards are now available in many varieties, but the labeling system used in this manual is compatible with all currently known variations. The following manual conventions will be used to make it clear which keys should be used:

1. All user-entered keystrokes are underlined.

2. If a letter is to be typed as a command, it may be either lower case or UPPER CASE.

3. Multi-letter keytop labels are shown in [BRACKETS]. For example:

   [Enter], [F1], [F8], [Ctrl], [Alt], [Shift], [Home], [PgUp], etc.

   Each [BRACKETED] set represents one key to be pressed.

4. Some keys must be held down while pressing a second key. These will be shown with a dash (-) between key presses.

   For example: [Alt]-C

   This notation should be interpreted as;

   press and hold the [Alt] key
   press and release the C key
   release the [Alt] key

5. The personal computer itself includes an automatic repeat feature if keys are held down for longer than 1/2 second. Be careful to avoid holding a printing key down for longer than is required.

6. Separate sequential command entries are separated by commas.

   For example: [F1], M implies:

   press and release the [F1] key
   press and release the M key.

A.2 PC-AMTOR Command Entry

All PC-AMTOR commands are entered in one of three ways:

1. Type [F1] to show the command menus. Use [arrow keys], [Enter], and [Space bar] to choose options; type [Esc] to back up one menu step.

2. Type "Hot-keys": [Alt]-Q, [Shift]-[F6], for example.

3. An "expert user" may use single-letter command abbreviations once [F1] is typed to enter command mode. For example, [F1], M enters command mode and selects the Mode menu window. The appropriate "expert" key associated with each command is shown in the command windows. The "expert user" may speed type the entire command sequence without waiting for each command menu to be displayed.

The use of command menus and "hot keys" will be discussed in this guide. The "expert user" will soon discover his own set of often-used key sequences.

A.3 COMMAND Menus

PC-AMTOR command menus are always accessed by typing the [F1] key, as prompted by the bottom line "Press F1 Key For Command Mode" message. The opening command menu appears as in Figure A.1. Note the instructions on the bottom line. Pressing [Enter] selects a menu for the highlighted option; the left and right arrow keys allow you to highlight and select different command menus; menu contents are customized for each code and mode you select. [Esc] always "backs-up" one level in the command menu.

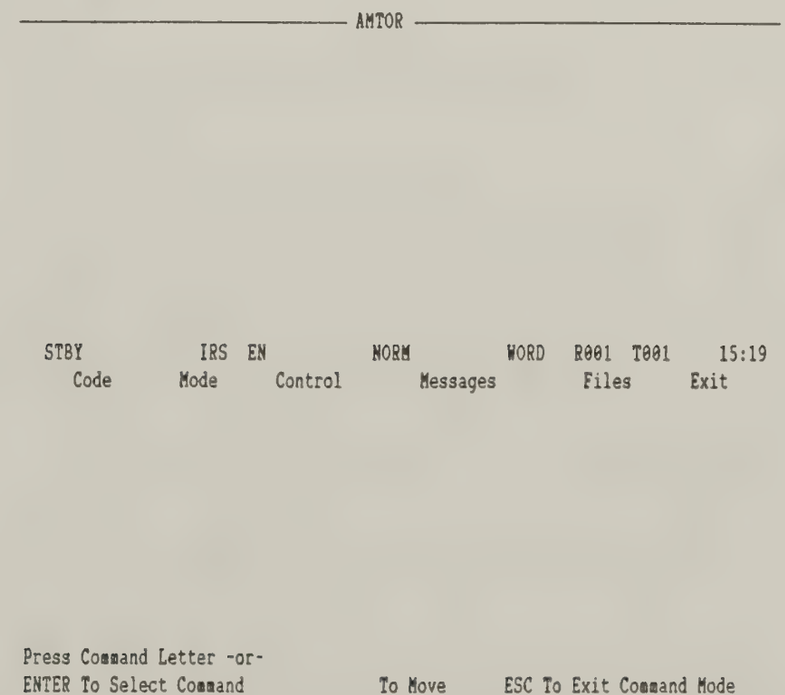

Figure A.1 Opening Command Menu

The "CODE" menu is shown in Figure A.2. Note that at this menu level you can use four arrow keys to make a selection - up, down, left and right. Select various codes within this menu with the up and down arrow keys, highlighting the desired code. Typing [Enter] will set the highlighted code. Conversely, you can use the left and right arrow keys to "slide" from menu to menu. Note, however, sliding horizontally between menus does not result in selection of any highlighted options. You can use this feature to examine which options are currently selected without changing the settings. Only [Enter] or [Space Bar] selects an option. As before, you can "back-up" one menu level for each press of the [Esc] key.

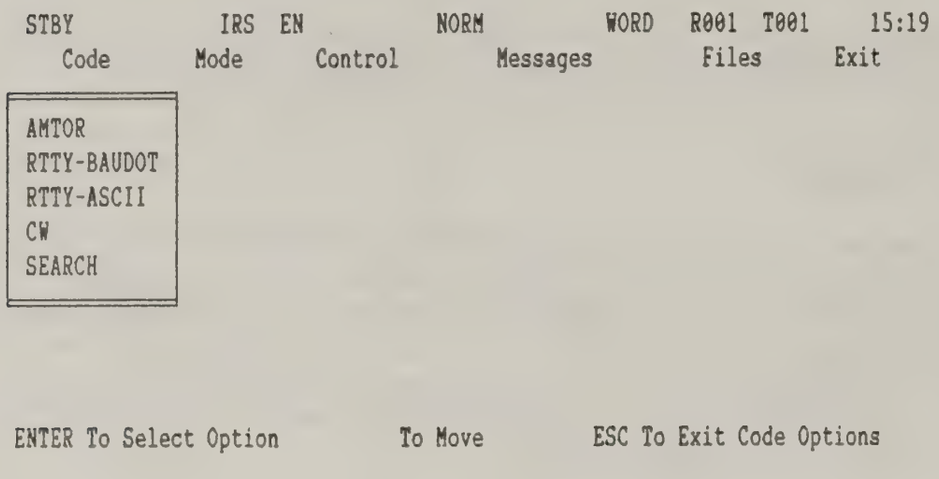

Figure A.2 CODE Menu

A.4 CONFIGURATION Menus

All frequently changed options are set using one of the main PC-AMTOR menus. There are also a number of optional parameters that may be accessed through "FILES" and then "CONFIGURATION" menus. The CONFIGURATION menu has two pages - one to set parameters and one to show stored messages and calls. Any parameter, message, or call sign may be changed through the CONFIGURATION menu.

The CONFIGURATION menu serves a dual purpose in PC-AMTOR:

1. CONFIGURATION menus permit you to view and change all PC-AMTOR parameters. Changes are effective for as long as the PCA program is operating.

2. When exiting PC-AMTOR, you have the option of saving all current CONFIGURATION menu settings for use the next time you run the program. You can therefore customize PC-AMTOR by changing the CONFIGURATION menu settings and saving the new values at Exit.

Typical CONFIGURATION menus are shown in Figure A.3 and A.4. See Section 3.7 of the REFERENCE MANUAL for more information concerning CONFIGURATION menu parameters.

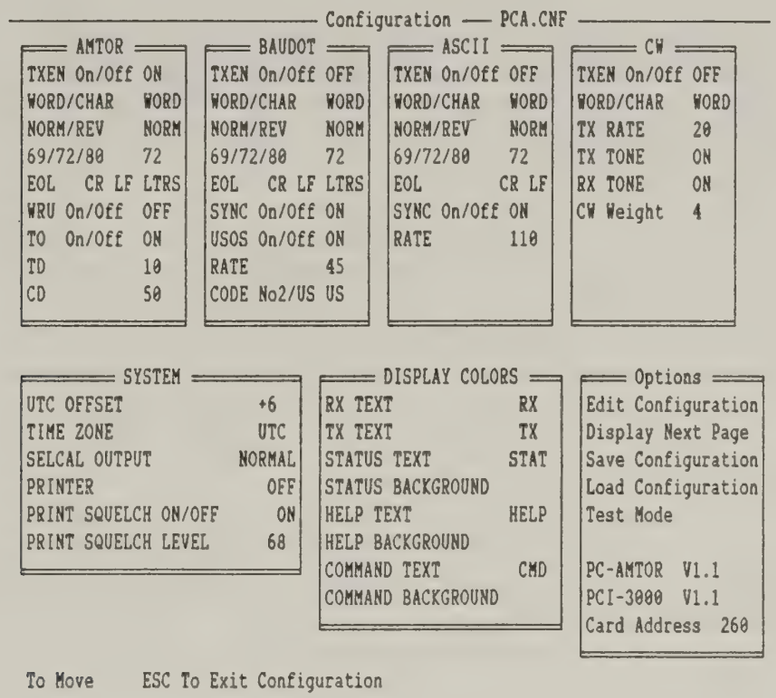

Figure A.3 CONFIGURATION Menu - Page 1

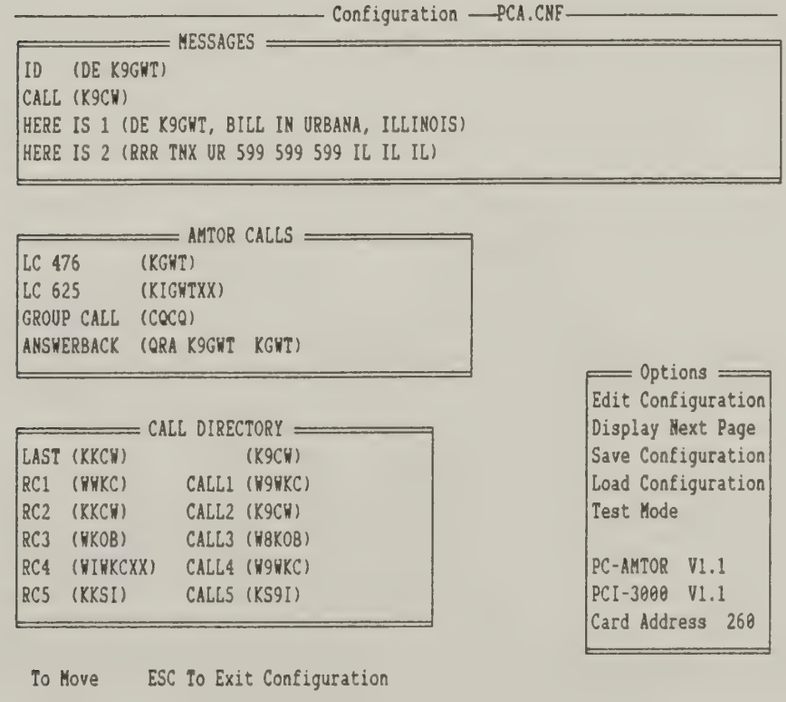

Figure A.4 CONFIGURATION Menu - Page 2

B. SCREEN TEXT BUFFERS

The PC-AMTOR screen is split to show received text in the upper half and transmit text in the lower half of the display. Three control and status lines are provided. The top line of the display shows information concerning mode, files, and messages to be sent. The middle line shows current operating parameters, and the bottom line prompts for Command Mode key operations.

B.1 Receive Screen and Receive Buffer

The upper ten lines of the screen show received text. In AMTOR, BAUDOT RTTY, and CW, the text will always show UPPER CASE letters, except when prosigns and "special" characters are received in CW. Received ASCII RTTY text will show upper and lower case letters as received. Special display formats are used to display unique aspects of each code. For example, the underbar shows receive errors in AMTOR modes, and unknown dot-dash CW combinations are shown in the form {*-*--**-}. These special cases are discussed in the chapters of this guide relating to each code (Chapters D, E, and F).

The receive text buffer has a total of 250 display lines of storage. The PC screen may be thought of as a 10-line "window" on the receive buffer. Note the "R001" and "T001" indicators on the center status line. These show the screen display position in the receive and transmit buffer. Also, note that on power-up, the "T001" characters are in reverse video compared to the rest of the status line characters. This means that the scroll keys will act upon the transmit buffer. The "T" specifies the Transmit buffer and the number shows the keyboard cursor position. If you type [Alt]-R, scroll control is now switched to the receive buffer, shown by reverse video of "R001". In this case, line "001" is lower screen line displayed. Newly received text is always written onto line 1 of the receive buffer. Previously received text is shown on higher line numbers; text on line 25 was received 25 lines before the current text. To control the transmit buffer, type [Alt]-T.

Special keys associated with the receive text display are shown in Table B.1.

TABLE B.1
RECEIVE DISPLAY CONTROL KEYS

KEY	FUNCTION
[Alt]-R	Set scroll key to control the receive buffer
[up arrow]	Scroll up one line
[down arrow]	Scroll down one line
[PgUp]	Scroll up ten lines (one screen)
[PgDn]	Scroll down ten lines (one screen)
[Ctrl]-[Home]	Scroll to show last received ten lines
[Ctrl]-[End]	Scroll to show earliest received ten lines
[Alt]-U	Clear Entire Receive buffer

BE CAREFUL ABOUT [Alt]-U! It clears the entire 250 line receive buffer. Once deleted, the text is not recoverable!

Receive text is displayed even while you may be using command mode to change parameters. However, you may not scroll the receive buffer while in command mode since the arrow keys then have a different meaning.

You may also use the FILES and SAVE menu options to save received text to a disk file. There are four types of save-to-disk operations: (1) save a selected portion of the receive buffer, (2) save newly received text to disk in one long file (continuous), (3) save to disk in a set of sequential files and (4) save NAVTEX messages to disk. The details of save-to-disk options are discussed in Section 3.8 of the REFERENCE MANUAL. NAVTEX mode is discussed in section D.5 of this OPERATOR'S GUIDE.

B.2 Transmit Screen and Transmit Text Buffer

The lower ten lines of the PC screen show text that will be transmitted. Note that you may type either upper or lower case letters, but only ASCII actually differentiates letters case when sending. In AMTOR, Baudot, and CW, "a" and "A" are both sent using the one code for "A".

The transmit buffer also has a maximum length of 250 lines, ten of which are displayed on the PC screen. The "T001" status indicator shows the line number of the current keyboard cursor position - where you are presently entering new text. In the transmit buffer, transmit text always starts at line number "001" and goes to the keyboard position. Scrolling and editing of the transmit buffer is selected by typing the [Alt]-X key combination, indicated by reverse video display of "T001".

Transmitted text is "echoed" in the receive buffer *as it is sent* (Echo As Sent, or "EAS"). The receive buffer will thus contain a copy of both sides of the QSO - what you received and what you sent.

The [Alt]-[F10] key combination controls the output of the transmit buffer and is indicated by the status indicators "RX" and "EN". The states of these indicators are shown in Table B.2.

TABLE B.2
TX/RX CONTROL STATES ([Alt]-[F10])

STATE		FUNCTION
RX	DIS	Receiving text. Typed text will not be transmitted
RX	EN	Receiving text, but newly typed text will interrupt reception and be immediately transmitted.
TX	ACT	Actively transmitting text

The state of transmit output is switched by typing the [Alt]-[F10] keys.

NOTE: Text cannot be typed into the transmit buffer when you are in COMMAND mode. However, if you have pre-typed text, start sending, and then enter COMMAND mode, the pre-typed text will continue transmitting.

You may pre-type none, some, or all of the transmit buffer space whenever you wish, even before an ARQ link is established or when receiving from the other stations. However, if you are receiving RTTY or CW, be sure to DISable the transmit buffer output using [Alt]-[F10] before pretyping to avoid transmitting on top of the other station! The transmit buffer has full flow-control in AMTOR ARQ mode and text will not be sent until the other ARQ station is ready.

If you have some pre-typed text in the transmit buffer, newly typed text will normally be entered after the pre-typed text. However, the transmit buffer also includes a full on-screen editor that may be used at any time before text is sent. You may use the editor to modify, delete, or insert text in the transmit buffer, even while earlier text is being sent. *See Table B.3 and Section 3.9 of the REFERENCE MANUAL for full details of editing operations.*

There are two ways to transmit files that are stored on disk: direct from disk and through the transmit buffer. It is generally more convenient to load a disk file into the transmit buffer, inspect and edit it, and then send the text. This technique also guarantees that the the text is sent using the end-of-line sequence and line lengths specified in the CONFIGURATION menu.

Transmitting direct from disk does not go through the transmit buffer and you cannot preview the text until is has been sent and echoed into the receive buffer. Direct-from-disk transmitting sends the text exactly as on the disk, using the end-of-line sequences and line lengths included in the disk file. This mode can be very useful when sending text requiring a special format, such as "RTTY pictures". *Disk file transmit operations are discussed in detail in Section 3.8.1 of the REFERENCE MANUAL.*

A number of special keys are provided to scroll and edit text in the transmit buffer. These keys are shown in Table B.3.

The [arrow], [Home], and [End] keys have two states. The key by itself moves the cursor one increment (one character or line). Using [Ctrl] with these keys expands the increment (one word, or top or bottom of transmit buffer). Editing may be done using either "INSERT" or "OVERTYPE" modes. "INSERT" mode means that additional characters are inserted at the cursor position and any following text is moved to the right and down as required. "INSERT" does not result in the loss of previously typed text. "OVERTYPE" mode enters newly typed characters at the cursor position, but the new characters replace any previously typed text after the cursor. Editing is toggled between INSERT and OVERTYPE by typing the [Ins] key. The OVERTYPE mode is indicated by the letters **OVR** on the bottom information line of the screen.

TABLE B.3
TRANSMIT BUFFER CONTROL KEYS

KEY	OPERATION
[Alt]-X	Set scroll key to control the transmit buffer
[left arrow]	Move cursor left one character.
[Ctrl]-[left]	Move cursor left one word.
[right arrow]	Move cursor right one character
[Ctrl]-[right]	Move cursor right one word
[up arrow]	Move cursor up one line
[down arrow]	Move cursor down one line
[PgUp]	Move cursor up ten lines (one screen)
[PgDn]	Move cursor down ten lines (one screen)
[Home]	Move cursor to beginning of line
[Ctrl]-[Home]	Move cursor to line 1, column 1
[End]	Move cursor to end of line
[Ctrl]-[End]	Move cursor to last text line of transmit buffer
BS ([Ctrl]-H)	Delete character to left of cursor
[Back arrow]	Delete character to left of cursor
[Del]	Delete character at cursor
[Ins]	Toggle between INSERT and OVERTYPE modes
[Alt]-F	Reformat current paragraph
[Alt]-K	Delete line
[Alt]-W	Delete word
[Alt]-V	Clear Entire Transmit buffer

BE CAREFUL ABOUT [Alt]-V! It clears the entire 250 line transmit buffer. Once deleted, text is not recoverable!

C. CALL SIGNS AND MESSAGES:

C.1 Programmable Messages

PC-AMTOR includes several different programmable call signs, ARQ SEL-CAL codes (SELective CALl), HERE IS messages, and ARQ WRU ANSWERBACK text. The following tables explain the various messages that may be programmed using Page 2 of the CONFIGURATION menu.

TABLE C.1
MESSAGES

LABEL	USE
ID	The call sign of *your* station (DE K9GWT, for example) (16 characters maximum; include "DE" if you want it to be sent).
CALL	The call sign of the *other* station (K9CW, for example) (16 characters maximum)
HERE IS 1	A custom message you may wish to send frequently (60 characters maximum)
HERE IS 2	A custom message you may wish to send frequently (60 characters maximum)

TABLE C.2
AMTOR CALLS

LABEL	USE
LC 476	The 4-letter ARQ SEL-CAL for *your* station (ex: KGWT) (4 letters required; *no numbers*)
LC 625	The 7-letter ARQ SEL-CAL for *your* station (ex: KIGWTXX) (7 letters required; *no numbers*)
GROUP CALL	The 4-letter SFEC SEL-CAL for *your* station (ex: CQCQ) (4 letters required; *no numbers*)
ANSWERBACK	Response message from *your* station to an ARQ WRU call. (32 characters maximum; ex: QRA K9GWT KGWT)

TABLE C.3
CALL DIRECTORY

LABEL	USE
LAST	SEL-CAL and Call Sign of *last called other station*
RC1	SEL-CAL and Call Sign of 1st Call Directory station
RC2	SEL-CAL and Call Sign of 2nd Call Directory station
RC3	SEL-CAL and Call Sign of 3rd Call Directory station
RC4	SEL-CAL and Call Sign of 4th Call Directory station
RC5	SEL-CAL and Call Sign of 5th Call Directory station (4 or 7 letters only for SEL-CAL) (16 characters maximum for call signs)

These messages are accessed in several different ways. All are displayed and may be programmed from the CONFIGURATION Menu (Figure A.4). In addition, the CALL DIRECTORY parameters may be programmed when you choose the "SEND ARQ" COMMAND menu option.

C.2 "Hot-Key" Message Access

The "current" set of SEL-CAL and Call Sign messages may be programmed or sent using "hot keys" as shown in Table C.4.

TABLE C.4
"HOT-KEY" MESSAGE ACCESS

"HOT-KEY"	OPERATION
[F2]	Load **CALL** plus **ID** into transmit buffer. Example: **K9CW DE K9GWT**
[Ctrl]-[F2]	Program *other station's* ARQ **SEL-CAL**. Example: **KKCW**
[F3]	Load **CALL** into transmit buffer (*his* call sign)
[Ctrl]-[F3]	Program **CALL** (*his* call sign) Example: **K9CW**
[F4]	Load **ID** into transmit buffer. (*your* call sign)
[Alt]-[F4]	Load **CW ID** into transmit buffer. Example: **DE K9GWT**
[F5]	Load **HERE IS 1** into transmit buffer.
[Ctrl]-[F5]	Program **HERE IS 1.** Example: **QSL UR RST 599 599 599 IN IL IL IL**
[F6]	Load **HERE IS 2** into transmit buffer.
[Ctrl]-[F6]	Program **HERE IS 2.** Example: **CQ CQ CQ DE K9GWT K9GWT KGWT KGWT**

The [F2] key is particularly useful since it combines both call signs (his and yours) into one identification phrase. You may choose to send only your call (ID) by using the [F4] key or his call (CALL) by using the [F3] key.

Also, note that CALL (the other station's call sign) is easily changed using "hot keys" [Ctrl]-[F3]. You only need to enter the other station's call sign - and not yours when programming. This makes for very convenient "contest mode" operation.

The [HERE IS] "hot-keys" are very useful for CQ messages and contest standard form reports. The CQ call example (HERE IS 2) illustrates the recommended format to be used when calling CQ in AMTOR FEC mode.

C.3 Your Station Parameters:

Since parameters for your station will not change frequently (if ever), these parameters are programmable only via the MESSAGES and CONFIGURATION menus. When first starting PC-AMTOR, you will therefore want to immediately go to the the MESSAGES or CONFIGURATION menu (Figure A.2) and set the text for your station. We suggest the formats shown in Table C.5.

TABLE C.5
LOCAL STATION MESSAGE EXAMPLES
(Local Call Sign = K9GWT)

PARAMETER	CONTENTS	EXAMPLE
ID	DE [your call sign]	**DE K9GWT**
HERE IS 1	[information 1]	**DE BILL, K9GWT, URBANA, IL**
HERE IS 2	[information 2]	**QSL UR RST 599 599 599 IL IL IL**
LC 476	[4-letter ARQ SEL-CAL]	**KGWT**
LC 625	[7-letter ARQ SEL-CAL]	**KIGWTXX**
GROUP CALL	[4-letter SFEC SEL-CAL]	**CQCQ**
ANSWERBACK	[ARQ WRU response]	**QRA K9GWT KGWT**

NOTE: Selection of AMTOR calls is further explained in Chapter D of this OPERATOR'S GUIDE.

Once these parameters have been programmed, select the "SAVE CONFIGURATION" menu option and type [Enter]. PC-AMTOR will now be customized to your station and will always start using these messages.

D. OPERATING AMTOR

AMTOR is an error-correcting communications mode. AMTOR actually has five sub-modes that may be chosen: (1) ARQ ("Mode A"), (2) FEC ("Mode B"), (3) Selective FEC ("Mode S"), (4) LISTEN ("Mode L"), and (5) STBY (Standby). Each sub-mode will be discussed in detail.

All AMTOR modes use a special error-correcting code. This is a 7-bit synchronous code that always has a data rate of 100 baud. AMTOR ARQ mode is sent in pulses and both stations transmit in a time-sequenced order. Each station automatically requests a repeat if an error is detected. FEC and SEL-FEC modes do not use pulses and sound much like RTTY. In FEC and SEL-FEC, each character is sent twice (with a time separation). AMTOR LISTEN mode is a pure receive-only mode that may be used to listen to ARQ, FEC, or SEL-FEC signals. LISTEN mode cannot correct errors in received ARQ mode signals. STBY mode is the normal "rest" condition of an AMTOR station when monitoring a frequency. If your station ARQ SEL-CAL code is received, PC-AMTOR automatically switches from STBY to ARQ mode and responds. FEC and SEL-FEC reception is also automatic from STBY mode. STBY and LISTEN modes are compared in section D.4.3.

D.1 ARQ Mode ("Mode A")

AMTOR ARQ mode may also be called "Mode A". The letters "ARQ" stand for Automatic Repeat ReQuest. ARQ is a full error-correcting mode in which one station sends a group of three characters and then the other station either sends an acknowledge or requests a repeat of a group received in error. Thus, the transmitters of both stations are pulsed ON and OFF. AMTOR ARQ mode requires use of transmitters and receivers that can rapidly switch between receive and transmit. Most recent models of amateur equipment have fast switching for AMTOR and Packet Radio. Consult your equipment manual if you have any doubts. ARQ QSO's may be between two stations only - no "round-tables".

D.1.1 Starting ARQ Mode

There are two ways to start an ARQ mode transmission; (1) using the COMMAND menus, and (2) using "hot keys".

The COMMAND menu method is:

1. Press [F1]
   The first COMMAND menu will appear with **CODE** highlighted.
2. Press [Enter]
   The **CODE** menu will be shown
3. Use the [up-arrow] or [down-arrow] keys to highlight **AMTOR**.
4. Press [Enter]
   The **MODE** menu will now be shown with **Send ARQ** highlighted
5. Press [Enter]
   The ARQ SEL-CAL menu now appears.
6. Type a new SEL-CAL code or choose one of the CALL DIRECTORY choices. (SEL-CAL codes are discussed in the following section).

The [F9] "hot key" by-passes steps 1 through 5 and immediately shows you the SEL-CAL menu. [F9] is by far the easiest way to get on-the-air in ARQ mode.

D.1.2 Entering ARQ SEL-CAL Codes

In ARQ mode, you must know the SEL-CAL of the other station to originate a call. Amateurs call CQ in FEC mode, giving their SEL-CAL code. Answer the CQ in ARQ mode using this SEL-CAL code. FEC CQ calls are discussed in detail in Section D.2.4 of this manual.

PC-AMTOR gives you several choices for SEL-CAL codes. A sample SEL-CAL menu is shown in Figure D.1.

```
Sending (KKCW)      >

LAST (KKCW)      (K9CW)
 1   (WWKC)      (W9WKC)
 2   (KKCW)      (K9CW)
 3   (WKOB)      (W8KOB)
 4   (WIWKCXX)   (W9WKC)
 5   (KKSI)      (KS9I)
```

Figure D.1 ARQ SEL-CAL Menu

Note that both the SEL-CAL and the full call sign of the other station are listed and that there are 6 options available. This is PC-AMTOR's unique "call directory". PC-AMTOR remembers the last ARQ SEL-CAL you used and offers it as the first option when sending. PC-AMTOR also stores SEL-CAL and call signs for up to five frequently worked stations.

The SEL-CAL codes in memory No. 4 has 7-letters rather than 4-letters. This is a CCIR-625 SEL-CAL code. You may use any combination of 7 letters you wish. The example shows a letter substitution for the call sign number ("I" = 9), and fill unused positions with "X". You may enter either 4-letter or 7-letter SEL-CAL codes in any memory. *ONLY LETTERS* may be used; numbers or other characters are NOT accepted in the SEL-CAL field.

Your first menu choice is to send the same SEL-CAL that you may have previously used. If this is the station you wish to call, answer "Y", type [Enter], and the ARQ calling sequence starts.

If this is not the station you wish to call, you may simply just type the SEL-CAL code for the station you wish to call, type [Enter], and you will be "on-the-air".

You may also select one of the Call Directory Numbers (1-5) or "N" and [Enter]. If you type a number, that Call Directory listing is loaded and you may send it by typing "Y" and [Enter].

If you typed "N" to the first query, you now have a chance to enter a new SEL-CAL in the "LAST" option -- or use the arrow keys to select one of the 5 Call Directory listings. You may type a NEW SEL-CAL and call sign, select one of the numbered listings, or enter a new SEL-CAL and call sign for a directory

listing. To enter or change a listing, highlight the SEL-CAL section, type the characters, press [Enter], right-arrow to the call sign section, type its characters, and [Enter]. After both the SEL-CAL and call sign fields have been filled-in, a final [ENTER] brings you back to "Sending xxxx" >". Type [Enter] and you will start calling the desired station.

Changes made in "LAST" or in any of the five call directory listings may be temporary or permanent. Once changed, these memories will remain as long as PC-AMTOR is running. When you exit PC-AMTOR, you have the choice of saving the current configuration or not. If you choose to save the current configuration, the new entries will be stored in the PCA.CNF file and reloaded the next time you run PC-AMTOR. If you choose "NO", the new setting will be discarded and PC-AMTOR will start with the previous entries when next loaded. *Section 3.7 of the REFERENCE MANUAL also explains how to change all programmable parameters in the CONFIGURATION menu.*

> *Several "hot-keys" may be used to send the ARQ SEL-CAL or the full call signs of either station. Refer to Section C of this OPERATOR'S GUIDE for detailed information.*

D.1.3 Establishing the ARQ Link

The sequence at the beginning of an ARQ QSO is as follows:

1. Press [F9]
2. Set SEL-CAL code and type [Enter]
3. Your station starts sending the other station's SEL-CAL code.
4. The other station recognizes his SEL-CAL and responds.
5. Enable your transmit buffer by typing [Alt]-[F10]
6. Start typing transmit text.

Once these steps have been successfully completed, the ARQ QSO may continue and you may send text to the other station. However, no text will be passed until the first five steps have been finished. When a link is in progress (not all five steps complete), the top line of the screen will display the message:

---- Calling - (KKCW) ---------- AMTOR ----------

The center status line will show:

ARQ ISS EN TFC/RQ NORM

This indicates that an ARQ call is in progress, you are the ISS (Information Sending Station), and that the call-up sequence is in progress. Your transmitter should now be pulsing ON and OFF ("chirping").

Once the link has been established, the "Calling" label will will change to "Linked With XXXX". If your receiver speaker is turned ON, you will also hear the other station's short "chirp" response (control signals).

If you do not get a response from the other station, the TIME OUT option controls whether your transmitter continues "chirping forever" (TO = OFF) or if the ARQ call automatically "times-out" (TO = ON). The TIME OUT (TO) option is normally set to "ON", but may be changed in the CONFIGURATION menu. *You may do a "quick-kill" or "panic-kill" at any time by typing the [Alt]-[F8] keys.* An in-progress AMTOR transmission may also be stopped by re-entering the COMMAND and CODE menus and selecting AMTOR (or any other code). Both procedures will return you to AMTOR "STBY" condition and the transmitter will cease its chirping.

D.1.4 The ARQ QSO

By now, the AMTOR link has been established and you may start typing text to the other station. Since you started the QSO, you are now the "ISS" - the Information Sending Station.

PC-AMTOR includes a transmit text buffer so that you may type as fast as you desire, but characters will always be transmitted at the proper rate. Transmitted characters are "echoed" on the receive screen *as they are sent* ("Echo As Sent"). You can always gauge the progress of the ARQ transmitted output by simply looking at the receive buffer. If your typing pauses or is not as fast as the transmitted rate, PC-AMTOR automatically inserts AMTOR "idle" characters as indicated by the "IDL" status word instead of "TFC" on the center status line.

If the ARQ link has detected errors, the "TFC"/"IDL" indicator will change to "ERR" to show that you have received an error or "RQ" to show that the other station has requested a repeat. The "ERR" and "RQ" labels will usually flash very quickly and may not be noticeable on good quality links. However, if either "ERR" or "RQ" are frequently observed, it may be a sign that the ARQ link is about to fail.

D.1.5 ARQ OVER Commands

In ARQ mode, information flow is *one-way*, even though both transmitters are alternately "chirping away". Thus, it is very much like all other amateur modes - RTTY, CW, or Voice - you send for a while and then let the other station send for a while. However, in AMTOR, we cannot just turn our transmitters ON and OFF to control who talks and who listens -- both transmitters are already switching ON and OFF.

AMTOR ARQ mode has a very special command to control which station sends text (ISS) and which station receives text (IRS). This is called the "OVER" command. There are two slightly different versions, "Normal OVER" the "Forced OVER".

If you are the current ISS (Information Sending Station), all you need to do is end your typed comments with the plus and question mark characters (+?). These characters are entered into the transmit buffer and a special ARQ control sequence is executed when [+?] is sent. The control sequence has the effect of reversing the roles of the two stations. Your station will now become the IRS (Information Receiving Station) and the other station becomes the ISS. He will then send text to you. Likewise, he can return sending control to you by typing [+?]. The ARQ QSO thus continues in the typical amateur back-and-forth manner with each station ending his comments with a +? sequence. You may enter

the OVER command by either typing the [F7] key or by typing +?. *This "OVER" command will work ONLY if you are the ISS.*

The "FORCED OVER" command is like full break-in CW. For example, you might be the receiving (IRS) station, but wish to interject a comment or otherwise interrupt the sending of the other station. Use the [Alt]-[F7] keys to inject a FORCED OVER operation. If you are the IRS, the FORCED OVER is the only way you can reverse the channel without waiting for the other station to finish his typing. Keep in mind that a FORCED OVER operates immediately and therefore interrupts whatever the other station is sending. Use it with care!

The ISS may also use [Alt]-[F7] to give a FORCED OVER. If so, the channel will turn-around as soon as you press [Alt]-[F7], without sending any text that may still remain in your transmit buffer. It is better practice to use +? or [F7] for a Normal OVER that is placed at the end of your transmit pre-typed text.

Even if a FORCED OVER is used, PC-AMTOR preserves any unsent text in the transmit buffer. It will be held until it is again your turn to transmit and then sent - *before any newly pretyped text.* You may, however, erase the entire transmit buffer at any time by typing [Alt]-V. Be careful - you can loose a lot of pre-typing!

To review the "OVER" options:

1. If ISS, type [F7] or +? at end of your text to be sent
2. If ISS or IRS, type [Alt]-[F7] to immediately reverse the channel.

D.1.6 AMTOR END Commands

AMTOR requires another special set of control codes to be sent at the end of the QSO. This is called the "END" command. If you are the ISS, END an AMTOR QSO by typing either the [F8] key or ZZZZ in the transmit buffer (actually, [F8] enters "ZZZZ" in the transmit buffer as well, but saves 3 key presses). When "ZZZZ" is sent, it automatically triggers the required AMTOR END control sequence.

As in the case of OVER, there is also a "FORCED END" command that you can use to immediately stop the link. You may use [Alt]-[F8] to give a FORCED END when operating as either ISS or IRS. *Note that a FORCED END operates immediately and does not wait until any pre-typed text has been sent.* Any unsent text will be cleared from the transmit buffer when [Alt]-[F8] is typed. [Alt]-[F8] may also be called a "panic-kill" for ARQ mode. (If the transmitter is smoking, you want to get off the air as soon as possible!)

D.1.7 ARQ WRU Feature

PC-AMTOR includes a WRU (Who aRe yoU) feature that allows the other station to confirm the identity of your station. APLink and some amateur mailboxes use WRU when you first connect to the system. A special character is sent by the APLink or mailbox station that causes PC-AMTOR to respond with the *ANSWERBACK* message (a special type of "HERE IS" message).

The PC-AMTOR WRU feature may be turned ON or OFF, using the CONFIGURATION and AMTOR / CONTROL menus. The ANSWERBACK message is loaded via the CONFIGURATION menu.

Assuming that you have WRU turned ON and an ANSWERBACK message programmed, the full operation sequence for WRU is as follows:

1. Other station is ARQ ISS and sends "$" (dollar sign; FIGS-D)
2. PC-AMTOR forces an OVER so that you are now the ISS
3. Your ANSWERBACK text is sent (no other text is sent)
4. PC-AMTOR sends a second OVER so that you are now back to IRS state.

You may program any ANSWERBACK text you wish up to a total of 32 characters. The following formats are suggested:

APLINK: QRA [call sign] [SEL-CAL] Ex: **QRA K9GWT KGWT**

OTHER: DE [call sign] (SEL-CAL) Ex: **DE K9GWT (KGWT)**

APLink looks for a WRU response and then uses your call sign and SEL-CAL to log-in your station. The latest versions of APLink will accept either of the above formats. Other mailbox stations may have slightly different format requirements.

WRU is a feature that should generally be left in the **OFF** state unless you are actively using APLink or a mailbox that requires WRU. The reason for this suggestion is that some amateurs may send the dollar sign as part of their AMTOR text. If your WRU is turned ON, he will get a very confusing response when he sends you the dollar sign. Also, even though AMTOR is an error correcting mode, it is not 100% infallible and errors can and do occur. Noise hits could therefore trigger unwanted OVER and ANSWERBACK transmissions. The WRU feature does not operate in FEC, SEL-FEC, RTTY, or CW modes and is NOT a general purpose message response feature.

UNLESS YOU NEED WRU, LEAVE THIS FEATURE TURNED OFF!

The PCI-3000 and PC-AMTOR include special requirements to prevent accidental false triggering of the WRU ANSWERBACK. These are:

When a FIGS-D ($) is received, the following conditions must be met before the ANSWERBACK text is sent:

1. WRU must be turned ON.
2. ANSWERBACK text must be programmed.
3. When received, the FIGS-D ($) must be followed by the AMTOR "IDLE.B" or CR/LF characters. Any following AMTOR "triplets" must not include data or errors (but can be "IDLE.B" control characters).

When the PCI-3000 sends a FIGS-D ($), it is sent so that the AMTOR "IDLE.B" character "fills" the current *and the following* data triplet.

These are the major features for use of AMTOR ARQ mode. Additional details are contained in Chapter 3 of the REFERENCE MANUAL. *The INDEX may also be of assistance if you have special requirements.*

D.2 FEC Mode ("Mode B")

AMTOR FEC mode may also be called "Mode B" or "Collective Broadcast Mode". The letters "FEC" stand for Forward Error Correction. FEC uses the same 7-bit character code as ARQ mode, but sends each character twice, separated by the time it takes to send four other characters (called a "4-character interleave"). If the first received character is in error, the FEC receiving equipment examines the second character. FEC is sent much like standard RTTY - one station transmits continuously and then turns OFF his transmitter to receive text from the other station. However, FEC code is not the same as RTTY and you must have an AMTOR decoder to receive FEC signals. Rapid switching times are not required for FEC mode. However, like RTTY, transmitting FEC imposes a 100% duty cycle on your transmitter (full power is always ON).
Amateurs use FEC mode for two purposes: (1) calling CQ for an ARQ mode QSO, and (2) a general "rag-chew" QSO using "RTTY-like" operating procedures. FEC is most frequently used to call a CQ which will lead to an ARQ mode QSO. However, FEC is also used in "round-table" situations where more than two stations may wish to participate in the same QSO.

D.2.1 Starting FEC Mode

To start FEC mode, access the COMMAND menu and select FEC. The following steps are recommended:

1. Press [F1]
   The first COMMAND menu will appear with **CODE** highlighted.
2. Press [Enter]
   The CODE menu will be shown
3. Use the [up-arrow] or [down-arrow] keys to highlight **AMTOR**.
4. Press [Enter]
   The MODE menu will now be shown with "Send ARQ" highlighted
5. Use the [up-arrow] or [down-arrow] keys to highlight **Send FEC**
6. Press [Enter]
   You are now in FEC mode
7. Type some text to be transmitted
8. Type [Alt]-[F10] to enable the transmit buffer output
   You will now be on-the-air in FEC mode.

FEC does not require a SEL-CAL code and may be used much like Baudot or ASCII RTTY modes. The "hot keys" for call signs and identification may be used as explained in Section C of this OPERATOR'S GUIDE. The transmit buffer and edit features are explained in Section B.

D.2.2 FEC Send/Receive Control

The FEC code itself includes special character sequences at the start and end of each FEC transmission. PC-AMTOR automatically inserts these - and intermediate idle sequences as required and no special operator or key operations are required.

Transmit/receive control of FEC is done entirely by the [Alt]-[F10] key combination. Once FEC mode has been selected, use [Alt]-[F10] to enable or disable the transmit buffer output. Table B.2 shows the three possible states of the transmit buffer and the status line indicator.

NOTE: The [Alt]-[F10] keys control transmit-receive state in FEC mode, but PC-AMTOR does not return to AMTOR-STBY mode in receive. Rather, PC-AMTOR remains in FEC-only receive mode so that you may conduct an FEC QSO. See the following section if you wish to return to STBY mode after an FEC transmission.

D.2.3 FEC Return to STBY Mode.

In some cases, it is desirable for PC-AMTOR to return to AMTOR-STBY mode rather than to FEC-only receive mode. Calling CQ for an ARQ mode response is such a situation. In this case, insert ZZZZ at the end of the transmitted text. The [F8] key may be used to insert the ZZZZ sequence.

FEC also includes a "panic kill" hot-key -- [Alt]-[F8]. In this case, pressing [Alt]-[F8] will causes an immediate end of FEC transmission, clears any unsent text out of the transmit buffer, and returns PC-AMTOR to STBY mode (not to FEC). *Use [Alt]-[F8] with restraint!*

D.2.4 Typical FEC CQ Call

FEC is often used by amateurs to issue a CQ call for an ARQ Mode QSO. A typical format for this CQ call might be as follows.

1. Select AMTOR - Send FEC via the COMMAND menus.
2. Type:

   CQ CQ CQ DE K9GWT K9GWT K9GWT (KGWT KGWT KGWT)
   CQ CQ CQ DE K9GWT K9GWT K9GWT (KGWT KGWT KGWT)
   ZZZZ

3. Press [Alt]-[F10] to enable the transmit buffer output
4. When the complete message has been sent, PC-AMTOR will return to STBY, ready for an ARQ call.

The CQ message may be pre-loaded into one of the two HERE IS buffers as explained in Section C of this GUIDE. The "ZZZZ" sequence may be loaded manually or loaded by typing the [F8] key. The above procedure will send your CQ call in FEC mode and return to STBY mode when complete. When the calling station answers in ARQ mode using your SEL-CAL, PC-AMTOR will automatically switch to ARQ, link, and the ARQ QSO will be in progress. The procedures for both stations to use FEC mode in a QSO are slightly different as will be explained in the following section.

NOTE: In any FEC transmission, do not start with a series of "RYRYRY.." characters. The "RYRYRY..." sequence may confuse the other station's equipment, preventing it from synchronizing to your FEC signal.

D.2.5 Typical FEC Mode QSO

If you want to have a QSO in which both stations send and receive in FEC mode, a slightly different procedure is used. In this case you want PC-AMTOR to return to FEC-receive rather than STBY mode when you have completed transmitting. You can do this by:

1. **DO NOT** end your transmission with ZZZZ, [F8], or [Alt]-[F8].

2. **DO** use the transmit buffer control key [Alt]-[F10] to control transmit and receive - just like RTTY as will be explained in Chapter E.

3. PC-AMTOR will *automatically* return to FEC-receive when all text in the transmit buffer has been sent. However, if you also wish to pre-type your next transmission, be sure to DISable the buffer output using [Alt]-[F10] before typing. (Otherwise, the transmitter will go back on-the-air and start sending the newly typed text.)

FEC is an error-correcting mode, but each character is sent only twice and there is no "repeat request" feature as in ARQ mode. Therefore, some reception errors will occur if both of the FEC repeat characters are flawed. When PC-AMTOR detects a reception error in FEC (and SEL-FEC), the error is shown on the screen as an underbar (_) symbol. *This is entirely normal and does not indicate a malfunction of PC-AMTOR or of the sending station's equipment.*

These are the major features for use of AMTOR FEC mode. Additional details are contained in Chapter 3 of the REFERENCE MANUAL. *The INDEX may also be of assistance if you have special requirements.*

D.3 SEL-FEC Mode ("Mode S")

AMTOR SEL-FEC mode may also be called "Mode S" or "Selective Broadcast Mode". SEL-FEC mode is a cross between ARQ and FEC AMTOR modes. SEL-FEC, like ARQ, uses a SEL-CAL code (called the "GROUP CALL"), but is a continuous send mode like FEC. However, data sent in SEL-FEC mode is *inverted* from that sent in FEC mode.

To date, SEL-FEC has not been a frequently-used AMTOR mode. It is a convenient mode to use if it is desired to send text to a group of stations, all using the same "GROUP CALL" SEL-CAL code. When SEL-CAL is used, amateurs typically use "CQCQ" as the GROUP CALL.

NOTE: GROUP CALL and ARQ SEL-CAL are not the same.

D.3.1 Starting SEL-FEC Mode

To start SEL-FEC mode, access the COMMAND mode and select SFEC. The following steps are recommended:

1. Press [F1]
   The first COMMAND menu will appear with **CODE** highlighted.
2. Press [Enter]
   The CODE menu will be shown
3. Use the [up-arrow] or [down-arrow] keys to highlight **AMTOR**.
4. Press [Enter]
   The MODE menu will now be shown with "Send ARQ" highlighted
5. Use the [up-arrow] or [down-arrow] keys to highlight **Send SFEC**
6. Press [Enter]
   The SEL-FEC SEL-CAL entry blank now appears.
7. Accept the default (CQCQ) by typing [Enter] or enter a new 4-character SEL-CAL code followed by [Enter].
8. Type some text to be transmitted
9. Type [Alt]-[F10] to enable the transmit buffer output
   You will now be on-the-air in SEL-FEC mode.

The "hot keys" for call signs and identification may be used as explained in Section C of this OPERATOR'S GUIDE. The transmit buffer and edit features are explained in Section B.

D.3.2 SEL-FEC END Commands

SEL-FEC requires a special set of control codes to be sent at the end of a transmission. This is called the "END" command. You may END the SEL-FEC transmission by typing either the [F8] key or ZZZZ in the transmit buffer (actually, [F8] enters ZZZZ in the transmit buffer as well, but saves 3 key presses). When "ZZZZ" is sent, it automatically triggers the required SEL-FEC END control sequence. SEL-FEC always returns to STBY mode at the end of a transmission.

There is also a "FORCED END" command that you can use when you want to get off the air quickly. Type [Alt]-[F8] to force an immediate END, regardless of whether or not all of your pre-typed text has been sent.

These are the major features for use of AMTOR SEL-FEC mode. Additional details are contained in Chapter 3 of the REFERENCE MANUAL. *The INDEX may also be of assistance if you have special requirements.*

D.4 LISTEN Mode ("Mode L")

PC-AMTOR also includes a receive-only mode so that we may listen to all AMTOR transmissions. The LISTEN mode (also called "MONITOR" or "Mode L") will automatically select the mode and decode characters from ARQ, FEC, or SEL-FEC received signals. It uses the same 7-bit code as the other AMTOR modes.

D.4.1 Starting LISTEN Mode

To start LISTEN mode, access the COMMAND menu and select LISTEN. The following steps are recommended:

1. Press [F1]
   The first COMMAND menu will appear with **CODE** highlighted.
2. Press [Enter]
   The CODE menu will be shown
3. Use the [up-arrow] or [down-arrow] keys to highlight **AMTOR**.
4. Press [Enter]
   The MODE menu will now be shown with "Send ARQ" highlighted
5. Use the [up-arrow] or [down-arrow] keys to highlight **LISTEN**
6. Press [Enter]
   You are now in LISTEN mode and received signals using ARQ, FEC, or
   SEL-FEC modes will be received and displayed.

The status-line indicators will show "ARQ", "FEC", or "SEL-FEC" when an AMTOR signal is detected and decoded. Also, the "PHS"/"TFC"/"ERR" indicator will show data type when a signal is being received.

D.4.2 LISTEN Mode Performance

LISTEN mode does not give full error-correction of received ARQ mode signals since it does not transmit repeat request signals back to the sending station. Rather, LISTEN "makes the best with what it hears" and either prints the decoded character or an underbar symbol for flawed characters. If the ARQ signal is strong, it may print perfectly with no errors. However, weak, fading, or signals with interference will likely show several errors per line, requiring some "interpretive reading" on your part.

LISTEN mode reception of FEC and SEL-FEC modes is essentially the same as when these modes are selected manually. However, as explained in Section D.2.5, some reception errors are possible in FEC and SEL-FEC modes and these errors are also shown as underbar symbols on the screen.

D.4.3 LISTEN vs STBY Modes

At first glance, it might appear that LISTEN and STBY modes are the same. However there are some major differences:

LISTEN:

1. RECEIVE ONLY - no transmitter operation
2. NO SEL-CAL A SEL-CAL match in ARQ or SEL-FEC is not required to obtain decoding and print-out characters
3. AUTOMATIC MODE SELECTION - ARQ, FEC, or SEL-FEC modes will all be decoded and displayed. The selected mode is shown on the status indicators.
4. PC-AMTOR returns to LISTEN after reception of a mode is complete.

Note that PC-AMTOR's LISTEN mode includes all AMTOR modes.

STBY:

1. SEND AND/OR RECEIVE - if an ARQ signal using your SEL-CAL is received, PC-AMTOR automatically changes to ARQ mode and starts transmitting the correct control signal response.
2. SEL-CAL REQUIRED - in ARQ and SEL-FEC modes, PC-AMTOR ignores received signals whose SEL-CAL codes do not match those programmed for your station.
3. AUTOMATIC MODE SELECTION - a received FEC signal will be displayed immediately; an ARQ mode QSO will be started automatically if the SEL-CAL matches yours; SEL-FEC print will begin if the GROUP CALL matches that stored for your station.
4. PC-AMTOR returns to STBY at the end of an ARQ, FEC, or SEL-FEC QSO.

D.5 NAVTEX Reception

NAVTEX is a special transmission of marine weather and navigational aid bulletins sent using standard AMTOR FEC transmissions on 518 kHz (try 520.24 kHz, LSB dial reading). It is intended for use by vessels and marine-related concerns located within 100 nautical miles of an ocean-shore station. It can often be heard at much greater distances, particularly if you have a sensitive receiver and good antenna for 518 kHz. Evening hours give the best long distance reception. The NAVTEX transmitters are not necessarily on-the-air continuously, and it may take some patience to locate the station and achieve proper tuning. Receive NAVTEX in PC-AMTOR by selecting AMTOR STBY or LISTEN modes.

NAVTEX messages are sent in a special format with a unique start, ID, and end character sequence. NAVTEX messages start with "ZCZC" followed by a two letter plus two number ID (GA56, for example). Each message ends with "NNNN". Each NAVTEX message may be repeated many times or updated as weather or marine conditions require.

PC-AMTOR includes a special file storage mode for NAVTEX messages that stores each message in a separate file, with each file name related to the NAVTEX message title. Multiple copies of the same message are not stored and new reception of a given weather message will replace the previous version. *Additional details of NAVTEX file storage are found in Section 3.8.2 of the REFERENCE MANUAL.*

E. OPERATING RTTY

E.1 RTTY Codes

PC-AMTOR includes two RTTY modes - Baudot, and ASCII. Either may be sent and received with data rates of 45, 50, 57, 74, or 110 bits-per-second (baud).

Baudot is the original 5-bit asynchronous RTTY code amateurs have used for many years. Baudot RTTY is still in active use on the HF bands. Baudot supports only upper-case letters, numbers, and some symbols (the same as used in AMTOR). Amateurs typically use 45 baud (60 WPM) or 74 baud (100 WPM) for HF Baudot RTTY. Either the "U.S. Military Baudot" or the "CCITT No. 2" Baudot character set may be selected via the CONFIGURATION menu.

ASCII is an 8-bit code commonly used for asynchronous computer communications. ASCII is sometimes used for HF amateur communications, but not as frequently as is Baudot. ASCII includes upper and lower case letters, numbers, and many symbols and control codes. Amateurs typically use 110 baud (100 WPM) for HF ASCII RTTY.

E.2 Starting RTTY Modes

To start RTTY modes, access the COMMAND menu and select RTTY-BAUDOT or RTTY-ASCII. The following steps are recommended:

1. Press [F1]
   The first COMMAND menu will appear with **CODE** highlighted.
2. Press [Enter]
   The CODE menu will be shown
3. Use the [up-arrow] or [down-arrow] keys to highlight **RTTY-BAUDOT** or **RTTY-ASCII**.
4. Press [Enter]

The status line will now show the selected CODE (BAUDOT or ASCII), and the selected speed, polarity, and other parameters. If these are the speed and parameters you wish to use, you are ready to start transmitting. If not, use the following steps.

5. Press [F1] to get the COMMAND menu again.
6. Use the [right-arrow] key to select **RATE**
7. Press [Enter]
8. Press the [up-arrow] or [down-arrow] keys to choose a speed.
9. Press [Enter]
10. Press the [right-arrow] key to select **Control**.
11. Press [Enter]
12. Use the [down-arrow] key to select any desired Control feature.
    Note, this menu uses the [Space Bar] key to toggle each option.
13. After all options have been set, type [Enter]
14. Type [Esc] two times to leave the COMMAND menu.

The extra steps of 5 through 14 are only necessary when you wish to change more than just the code to be used. The speed and control parameters may be set to default values using the CONFIGURATION menu as explained in Section A.3.

E.3 RTTY Data Rates

Steps 5 through 14 in the above procedure allow setting of the Baudot or ASCII data rate. -There are five data rates in common use for amateur HF RTTY. These are: 45, 50, 57, 74, and 110 baud. Either Baudot or ASCII may be used at any of these rates, but common usage is Baudot at 45 baud ("60 WPM") or 74 baud ("100 WPM") and ASCII at 110 baud ("100 WPM"). The Baud and WPM equivalents for each code and speed are shown in Table E.1.

TABLE E.1
RTTY DATA RATES AND SPEEDS

CODE	BAUD	WPM	COMMENTS
BAUDOT	45	60	"Standard" Baudot Speed
BAUDOT	50	66	"European" Baudot Speed
BAUDOT	57	75	"Weather" Baudot Speed
BAUDOT	74	100	Most Baudot "Mailboxes"
BAUDOT	110	137.5	Non-standard Speed
ASCII	45	41	Non-standard Speed
ASCII	50	45	Non-standard Speed
ASCII	57	52	Non-standard Speed
ASCII	74	67	Non-standard Speed
ASCII	110	100	"Standard" ASCII Speed

A special "Hot Key" is included for rapid RTTY data rate changes. Type [Alt]-A to increment through the available RTTY data rates. Each press of [Alt]-A increases the rate one "notch".

E.4 RTTY CONTROL Options

The available CONTROL menu options are shown in Figure E.1.

Control

TX EN/DIS	**DIS**
WORD/CHAR	**WORD**
NORM/REV	**NORM**
SYNC ON/OFF	**ON**
USOS ON/OFF	**ON**

Figure E.1 RTTY Control Options

Note: the "USOS" option is available only for Baudot code.

E.4.1 TX EN/DIS Option

This option controls the state of the transmit buffer and radio transmit/receive control signal (PTT line). In "DIS" (DISabled) state, the transmitter will not be turned ON and text typed into the transmit buffer will be held until this control is set to "EN" (ENabled). "DIS" is the normal receive state. This control changes from "DIS" to "EN" each time this option is selected and [Space Bar] is typed. "Hot-key" [Alt]-[F10] also toggles the state of this control. Key [Alt]-[F10] is normally used in this manner to control the transmit/receive state of your RTTY station.

The "EN" (ENabled) condition actually has two states:

1. If you have pre-typed text into the transmit buffer and the state is changed from "DIS" to "ACT", the transmitter is turned ON (PTT line to TX condition) and text is sent at the chosen code and data rate. There is a short delay of Mark-only condition at the start to assure that your transmit relays are actually in transmit state before data is sent.

   The transmitter will remain "on-the-air" and text will be sent for as long as text remains to be sent. After the last text character has been sent, the PTT line reverts to receive and you will again be able to receive RTTY. In this case, the state reverts to "EN" and "RX" since there is no text to be sent. The send-to-receive transition is also affected by WORD mode and SYNChronous idle as will be explained shortly.

   An immediate return to receive may be made at any time by typing [Alt]-[F10] again or by accessing the COMMAND and CONTROL menus and selecting the "TX EN/DIS" option.

2. If there is no pre-typed text in the transmit buffer and the state is changed from "DIS" to "EN", PC-AMTOR and your radio will remain in receive condition. However, the state will immediately change to transmit (ACT) as soon as you type the first character into the transmit buffer. This mode is analogous to "full break-in".

In actual use, most amateurs prefer to always set this option to "DIS" except when it is their turn to transmit. This allows pre-typing your response while receiving the other station ("ASR" mode).

HINT: IT IS SIMPLEST TO USE [Alt]-[F10] TO CHANGE FROM TX/RX IN RTTY.

E.4.2 WORD/CHAR Option

PC-AMTOR may be set to either WORD or CHARacter transmit modes. Assuming that you have not pre-typed any transmit text, in "CHAR" mode the transmitter will be turned ON and each character will be sent as you type it. There is a one second delay between the last character sent and switching from TX to RX, but if you are a slow typist, the transmitter can "pop" ON and OFF frequently - very disconcerting to you and the receiving station. "CHAR" mode is not recommended for most RTTY operations, but is a preferred mode for CW (Section F of this Guide).

In WORD mode, the transmitter is turned ON when you type the first character of a word, but no data is sent until you have completed the word. The transmitter stays in "Mark-hold" until a complete word is ready for transmission (or sends SYNC-idles if SYNC is also ON - see next section). WORD mode thus allows you to correct spelling and other typographical errors before they are sent.

IMPORTANT: For the purposes of WORD mode, a "word" is defined as the characters and following space(s) to the first letter of the next word; OR if a "new line" is started in the transmit buffer. Therefore, a "word" is not released to be transmitted until you either start typing the next word or you end the current line. The transmitter will stay in "Mark-hold" (or SYNC-idle) state until the new word is released for transmission.

HINT: WORD mode is the *preferred* mode for RTTY transmission.

E.4.3 NORM/REV Option

This option allows selection of the polarity of your RTTY signal. It sets the polarity of both the receive and transmit data sections of the PCI-3000. Use "NORM" polarity for most amateur RTTY operations. Be sure that your radio is also set to "LSB" or "FSK" mode. The present amateur "NORMAL" RTTY polarity standards are:

PC-AMTOR:	NORM polarity
TONES:	Mark = 2125 Hz; Space = 2295 Hz
	(Export: Mark = 1275 Hz; Space = 1445 Hz)
RADIO:	LSB or FSK mode

AMTOR, Baudot-RTTY, and ASCII-RTTY all follow these standards.

NOTE: "Hot-Key" [Alt]-N also changes NORM/REV.

E.4.4 SYNC Option

The SYNC option is often called "SYNC-IDLE" or "RTTY DIDDLE". When ON, it will insert non-printing characters in the transmit data stream if your typing has not produced a word or character to be transmitted.

In Baudot RTTY, the "LTRS" (Letters) character is sent; in ASCII, the "NULL" character is used. Both are "non-printing" characters and may help the other station's demodulator and display ("printer") maintain synchronization with your RTTY signal.

IMPORTANT:

HAL recommends that both WORD and SYNC options be turned ON when operating RTTY. In this case, you MUST end each RTTY text with a blank new line in the transmit buffer. The SYNC feature turns OFF and allows automatic return to reception only when all possible words have been sent. A blank new line condition is the only way to assure that this occurs. This is the same WORD and SYNC mode used in all previous HAL RTTY terminals (DS3100, DS2000, DS2050, CT-2100, CT-2200, PCI-2000).

E.4.5 USOS Option

This is a special option only for Baudot RTTY. Baudot code uses most 5-bit combinations twice - once for letters and again for numbers and symbols. A special pair of Baudot characters set the receiving terminal to the correct "shift" - Letters (LTRS) or Figures (FIGS). Noise can and does often appear to be a LTRS or, worse, FIGS baudot character. The receiving station may therefore be unintentionally set to FIGS case by noise, corrupting what would otherwise be printable text.

The USOS (**U**n**S**hift **O**n **S**pace) option works only on Baudot receive and will reset PC-AMTOR's Baudot receive case to LTRS after reception of *every* Space-Bar character. It is recommended that USOS be turned ON for most amateur Baudot RTTY use. However, some applications such as NAVY MARS and reception of some numerical data may require that USOS be turned OFF. USOS works *only* on Baudot RTTY and has *no effect* on ASCII RTTY.

E.5 Baudot FORCE LTRS Key

In addition to the USOS option, the [Alt]-L key combination may be used to force your Baudot receive terminal to LTRS case at any time. If you actively watch the print as received, you may prefer to use [Alt]-L to manually set LTRS condition rather than use USOS.

E.6 CW ID

RTTY CW ID is not required of U.S. amateur stations, but it may still be required in some countries. PC-AMTOR includes provision for sending your call sign in CW using the [ALT]-[F4] key. When pressed, the same text as programmed for your ID (normal F4 key) will be inserted in the transmit buffer in "bracketed form". For example, if "DE K9GWT" is my normal RTTY ID, the CW ID will be identified as >DE K9GWT<. When this bracketed ID is about to be sent, PC-AMTOR will automatically change to CW mode and send the bracketed text in CW at 20 WPM.

The RTTY CW ID sends "Space" transmit state for key-down and "Mark" state for key-up. PC-AMTOR automatically reverts to the chosen RTTY code and rate after completion of the CW ID. The CW-ID must be inserted manually in the transmit buffer using the [Alt]-[F4] keys. If your amateur regulations have a minimum time period between CW ID's, you must keep track of such times and insert CW ID's as required.

If you send RTTY pictures, you must manually enter [Alt]-[F4] at the time at which you wish to send a CW ID. You may wish to avoid sending CW ID in the middle of a picture transmission as it could disrupt the other station's "picture".

E.7 Other RTTY Options

Additional RTTY options may be set by using the CONFIGURATION menu page (see Figure A.3 and section 3.7.3.2 of the REFERENCE MANUAL).

E.7.1 Length of Transmit Line

The length of a transmitted line may be changed from 69 to 72 to 80 characters. The line length may be set to different numbers for Baudot and ASCII. The U.S. standard is 72 characters for Baudot and 80 characters for ASCII. The European standard for Baudot is 69 characters. The AMTOR CCIR-476 and CCIR-625 standard is 69 characters. U.S. NAVY MARS also uses 69 character lines for Baudot.

E.7.2 End Of Line Sequence

The "EOL", End Of Line sequence may also be set for both ASCII and Baudot. HAL recommends that you use "CR LF LTRS" for Baudot and "CR LF" for ASCII. Some applications such as NAVY MARS and RTTY pictures may require different EOL sequences.

E.7.3 Baudot Character Set

Two Baudot characters sets are in use: the "U.S. Military" Baudot character set or that designated as "CCITT No. 2", the "European standard". The differences between the two codes are minor, but can be significant for some applications. The differences between the two codes are outlined in Table E.2.

TABLE E.2
U.S. vs CCITT No. 2 BAUDOT

CODE	U.S. Baudot	CCITT No. 2 in PC-AMTOR
FIGS-D	$ (dollar sign)	$ (dollar sign)
FIGS-H	# (number sign)	(number sign)
FIGS-J	' (apostrophe)	BELL
FIGS-S	BELL	' (apostrophe)
FIGS-V	; (semi-colon)	= (equal sign)
FIGS-Z	" (quotation)	+ (plus sign)

AMTOR uses the CCITT No. 2 code and therefore the "=" and "+" keys are operational in AMTOR. U.S. amateurs generally use the U.S. version of the Baudot code. Computerized stations may use either set. If, when receiving Baudot, your signal "BELL" "beeps" frequently, the other station is probably using the opposite Baudot code from what you are. RTTY pictures and NAVY MARS use the U.S. Baudot character set.

E.8 RTTY Print Squelch

RTTY receive includes a "print squelch" control that can be used to suppress screen display of "garbage characters" that may result from reception of noise when a valid RTTY signal is not being received. The "print squelch" control functions much like the squelch control on a VHF-FM receiver, but it is a digital keyboard control on PC-AMTOR. Special status indicators and key combinations are provided to control print squelch.

To set PRINT SQUELCH, you must first be sure that you are NOT in COMMAND mode (no COMMAND menus). Then, type [Alt]-P. A new menu will then appear in the transmit buffer to set "Print Squelch Level" and "Print Squelch ON/OFF".

Think of "Print Squelch Level" as a control knob position from "00" to "99". At the low end of the scale ("00"), all signals will be printed - squelch is essentially turned OFF. At the upper end of the scale ("99") no signals will be printed - squelch is turned ON. HAL suggests that you start with a level setting between "60" and "70"; "65" is a good starting place.

The PRINT SQUELCH LEVEL may also be changed by typing the [+] and [-] keys. The [+] key increases the level and the [-] key decreases the level.

After setting a print squelch level, enable the squelch by using the [down-arrow] key to highlight the "ON/OFF" option. Type the [Space Bar] key to change the state (toggle between ON and OFF). When both the level and ON/OFF control have been set, return to the operating screen by either typing [Enter] or [Esc].

When PRINT SQUELCH is turned ON, the space immediately to the right of "BAUDOT" or "ASCII" on the center status line will be shown in reverse video. Tune to a RTTY signal and note that when the signal has exceeded the squelch level, a star (*) appears in this reversed video area. When the star is on the screen, print squelch is turned ON and the received signal meets the squelch level requirements.

Some points to consider when using PRINT SQUELCH are:

1. PRINT SQUELCH *only* works with RTTY - Baudot or ASCII.
2. PRINT SQUELCH has *no effect* on AMTOR or CW signals.
3. Setting too high a PRINT SQUELCH LEVEL requires very accurate tuning and you may miss some characters if the signal is weak, fading, poorly tuned, or if the shift of the signal differs from 170 Hz.
4. Setting too low a PRINT SQUELCH LEVEL will allow "hits" on noise between the end of one transmission and the start of another. A low setting will also extend the time after a signal quits that noise "hits" are printed.
5. The optimum PRINT SQUELCH LEVEL may change with receiver filter settings and with background noise levels from band-to-band and from day-to-day. A narrow receiver filter will require a higher PRINT SQUELCH LEVEL setting to eliminate noise "hits".
6. You can "fine-tune" the level by tuning the RTTY signal and then adjusting the PRINT SQUELCH LEVEL while watching the status line star. The [+] and [-] increment keys are very useful for this adjustment.

E.9 Special RTTY Transmit Keys

Special key combinations are provided to allow transmitting special RTTY characters. These keys are shown in Table E.3

TABLE E.3
SPECIAL RTTY TRANSMIT KEYS

KEY	CHARACTER	NOTES
[Ctrl]-G	Signal Bell	"Diamond" symbol on screen
<	LTRS	Only Baudot and AMTOR
>	FIGS	Only Baudot and AMTOR
[Alt]-M	12 LTRS	Sequence of 12 LTRS

The [Alt]-M key (12 letters) is a special requirement for U.S. NAVY MARS message formats.

These are the major features for use of RTTY modes. Additional details are contained in Chapter 3 of the REFERENCE MANUAL. *The INDEX may also be of assistance if you have special requirements.*

F. OPERATING CW

PC-AMTOR will send and receive Morse code (CW) at speeds from 5 to 50 WPM. The receive speed automatically tracks that of the received CW signal. Transmit speed is set in increments of 1 WPM. Morse code dot-dash combinations and character set conform to those defined by the ARRL in the 1989 Radio Amateur's Handbook.

F.1 Starting CW Mode

To start the CW mode, access the COMMAND menu and select CW. The following steps are recommended:

1. Press [F1]
   The first COMMAND menu will appear with **CODE** highlighted.
2. Press [Enter]
   The CODE menu will be shown
3. Use the [down-arrow] key to highlight **CW**.
4. Press [Enter]

This places PC-AMTOR in CW-receive mode.

F.2 Receiving Morse code

Tune-in a CW signal on your receiver and adjust tuning for an 800 Hz beat tone. The HAL SPT-2 SPECTRA-TUNE (or SPT-1) is highly recommended when tuning a CW signal. The CW filter in PC-AMTOR is 200 Hz wide -- accurate tuning is *REQUIRED.* When a CW signal is correctly tuned, a star (*) character will flash ON and OFF on the center status line (between "TX20" and "RX/TX"). This "star" is visible when the receive signal is in key-down state. Tuning may also be set to the "center" of the frequency range over which the star flashes.

PC-AMTOR also includes a receive "side-tone" which may be set ON or OFF using the [Alt]-C key combination. When ON, the PC tone generator is used to "beep" an 800 Hz tone each time the detected signal is in key-down state. Use this feature to match the receiver beat tone to the 800 Hz side-tone from the PC. With practice, this is a very simple and accurate way to tune CW signals.

The approximate receive Morse code speed is shown on the center status line (RX20 for 20 WPM, for example). PC-AMTOR will automatically adapt to the speed of the sending station.

The CW receive algorithm of PC-AMTOR will accurately decode most Morse code signals. However, computer reception of CW does have its limits and our computer will NOT always copy as well as a good CW operator. Sloppy sending, noisy signals, and heavy interference will all degrade computer reception. Accurate tuning and a narrow CW filter in your receiver may help considerably.

A common sending error is to run-together the dot-dash code elements of two or more characters. In this case, PC-AMTOR has no way to determine when one character has ended and the next begins. Instead, it tries to decode the run-together sequence as one character. If such a dot-dash combination exists, that is the character you will see on the screen - not what the sender "intended", but what he actually sent! If a valid dot-dash combination does not exist, PC-AMTOR gives you all the information it has - the dot-dash combination received in the following format:

{-*****} ("T H E", but run-together)

You, the operator can be "interpretive" and know that what the sender really intended was the word "THE". Call signs are also a common run-together problem. "Unknown" dot-dash combinations are always displayed in braces { }.

If more than three braced { } code combinations are printed, the PC-AMTOR algorithm assumes that a radical speed change has occurred (new speed or new signal), and re-sets its speed-tracking algorithm. When this occurs, from 1 to 3 characters may be lost or garbled as the speed is adjusted.

A special case of run-together characters is CW prosigns (AR, SK, AA, BT, etc.). PC-AMTOR recognizes and prints the common CW prosigns in lower case characters.

The full PC-AMTOR CW receive character set is shown in Table F.1.

F.3 Sending Morse Code

Sending Morse code is very simple - just set the desired WPM speed and start typing. The following procedure is recommended:

1. Press [F1]
   The COMMAND menu will be displayed
2. Use the [right-arrow] key to highlight **Rate**.
3. Press [Enter]
   The menu will now ask for a CW transmit speed in WPM
4. Type [Enter] to use the pre-set speed or type two digits (05 to 50) plus [Enter] to set a new transmit speed.
5. Press [Esc] to exit the COMMAND menu

Use [Alt]-[F10], the transmit buffer control, to control transmit text output as discussed in Section C of this GUIDE. HAL suggests that you use "CHAR" mode when sending CW, rather than "WORD" that is used for AMTOR and CW.

CW transmit includes a transmit side-tone output that may be enabled or disabled using the [Alt]-S key combination. This is NOT the same as the receive side-tone discussed previously. Many transceivers already have a CW transmit side-tone and you may wish to leave this feature turned OFF.

NOTE: "Hot Key" [Alt]-A may be used to increase CW transmit Speed; use [Shift]-[Alt]-A to decrease speed.

TABLE F.1
CW RECEIVE CHARACTER SET

LETTER	CODE	DISPLAYED
A	*-	A
B	-***	B
C	-*-*	C
D	-**	D
E	*	E
F	**-*	F
G	--*	G
H	****	H
I	**	I
J	*---	J
K	-*-	K
L	**-*	L
M	--	M
N	-*	N
O	---	O
P	*--*	P
Q	--*-	Q
R	*-*	R
S	***	S
T	-	T
U	**-	U
V	***-	V
W	*--	W
X	-**-	X
Y	-*--	Y
Z	--**	Z
1	*----	1
2	**---	2
3	***--	3
4	****-	4
5	*****	5
6	-****	6
7	--***	7
8	---**	8
9	----*	9
0	-----	0

SYMBOLS/PROSIGNS	CODE	DISPLAYED
PUNCTUATION:		
(slash)	-**-*	/
(period)	*-*-*-	.
(comma)	--**--	,
(query)	**--**	?
(colon)	---***	:
(semi-colon)	-*-*-*	;
(paren)	-*--*-	)
(quote)	*-**-*	"
(dollar)	***-**-	$
(apostrophe)	*----*	'
(underline)	**--*-	_
(error)	********	{********}
	(6 or more dots)	
PROSIGNS:		
AA (all after)	*-*-	aa
AR (end of message)	*-*-*	ar
AS (wait)	*-***	as
BT (pause)	-***-	bt
KA (start of message)	-*-*-	ka
KN (restricted over)	-*--*	kn
SN (understood)	***-*	sn
SK (end of QSO)	***-*-	sk
SPECIAL CHARACTERS		
a	*--*-	a
e	**-**	e
n	--*--	n
o	---*	o
s	----	s
u	**--	u
z	--**-	z

F.3.1 CW Transmit Weight

CW is normally sent at the "standard weight" ratio of one dash = 3 dot periods. This may be adjusted by entering the CONTROL and CONFIGURATION menus and setting a "weight" number from 0 to 8. Weight "4" is "standard", less than 4 is "light" (short dots and dashes); greater than four is "heavy" (longer dots and dashes). The WPM speed of your CW does NOT change with weight adjustment. A weight of "0" shortens dots and dashes by 1/2 dot width; each unit increment of weight increases dot and dash lengths by 1/8 of a "standard" dot width for the chosen speed ("4" corresponds to 1/2+4/8 = 1.0 dot width).

F.3.2 Special CW Transmit Keys

PC-AMTOR includes all letters, numbers, punctuation, and prosigns listed in Table F.1. To send letters, numbers, and punctuation, just type the appropriate key and the dot-dash combination will be sent. Note - only the right parenthesis "(" key sends {-*--*-}. Prosigns and Special Characters, however, require a few special keys so that they are sent in their correct run-together fashion. These prosigns and their keys are shown in Table F.2. As for CW receive, prosigns are displayed as their *lower-case* letter equivalent.

TABLE F.2
CW TRANSMIT KEYS FOR PROSIGNS AND SPECIAL CHARACTERS

PROSIGN	CODE	DISPLAY	KEY COMBINATION
AA (all after)	*-*-	aa	<
AR (end of message)	*-*-*	ar	+
AS (wait)	*-***	as	>
BT (pause)	-***-	bt	=
KA (start of message)	-*-*-	ka	@
KN (restricted over)	-*--*	kn	(
SN (understood)	***-*	sn	#
SK (end of QSO)	***-*-	sk	*
(error)	******** (8 dots)	{********}	!
SPECIAL CHARACTERS:			
a	*--*-	a	Ctrl-A
c	-*-**	c	Ctrl-C
e	**-**	e	Ctrl-E
n	--*--	n	Ctrl-N
o	---*	o	Ctrl-O
s	----	s	Ctrl-S
u	**--	u	Ctrl-U
z	--**-	z	Ctrl-Z

These are the major features for use of CW mode. Additional details are contained in Chapter 3 of the REFERENCE MANUAL. *The INDEX may also be of assistance if you have special requirements.*

G. AUTO SEARCH RECEIVE MODE

PC-AMTOR includes a mode that will automatically search for the proper Code, Mode, and Speed of a received data signal.

G.1 Starting AUTO SEARCH Mode

To start the AUTO SEARCH mode, access the COMMAND menu and select SEARCH. The following steps are recommended:

1. Press [F1]
   The first COMMAND menu will appear with **CODE** highlighted.
2. Press [Enter]
   The CODE menu will be shown
3. Use the [down-arrow] key to highlight **SEARCH**.
4. Press [Enter]
5. Tune-in a signal (AMTOR, RTTY, or CW)
6. Press [F10].
   PC-AMTOR will search for a match and start printing.

G.2 Available AUTO SEARCH Mode Combinations

AUTO SEARCH is arranged to test for popular combinations of AMTOR, BAUDOT RTTY, ASCII RTTY, and Morse code speeds and polarities. It may therefore take some time to choose the proper settings. It may also not necessarily choose the right combination. If you do not see understandable print, try typing the [F10] key again. Each [F10] operation restarts the mode search operation.

To speed-up the operation of AUTO SEARCH and to make sure that only "logical" combinations are tested, the search is limited to just those code/mode/rate combinations that are in common amateur usage. For AMTOR and RTTY, AUTO SEARCH is based upon an examination of the data rate, framing, and then polarity. In addition, the RTTY autoprint and CW detector output are examined to make a CW vs AMTOR/RTTY decision. The available combinations of AUTO mode are given in Table G.1.

TABLE G.1
AUTO SEARCH COMBINATIONS

DATA RATE	DATA TYPE	FRAME	FORMAT	CODE/MODE
110 Baud	Asynchronous	8 bits	Continuous	ASCII RTTY
100 Baud	Synchronous	7 bits	Pulsed	AMTOR ARQ
100 Baud	Synchronous	7 bits	Continuous	AMTOR FEC
100 Baud	Synchronous	7 bits	Continuous	AMTOR SEL-FEC
74 Baud	Asynchronous	5 Bits	Continuous	BAUDOT RTTY
57 Baud	Asynchronous	5 Bits	Continuous	BAUDOT RTTY
50 Baud	Asynchronous	5 Bits	Continuous	BAUDOT RTTY
45 Baud	Asynchronous	5 Bits	Continuous	BAUDOT RTTY
5-50 Baud	ON/OFF	none	Pulsed	CW

Only the combinations shown in Table G.1 are tested during AUTO SEARCH. These are the most common combinations of rate and code used in amateur radio. Other combinations, such as 45 baud ASCII RTTY or 110 baud BAUDOT RTTY may still be received, but only by manually setting these parameters as explained in Chapter E of this OPERATOR'S GUIDE.

The selected CODE, MODE, and RATE will be displayed on the center status line.

Once SEARCH mode has selected a code, mode, and rate, PC-AMTOR locks into that setting and becomes a SEND and RECEIVE terminal. You may therefore use SEARCH mode to "capture" a signal and then go ahead and have a QSO in that code. However, PC-AMTOR remains in SEARCH mode and each press of the [F10] key will restart the SEARCH process. To disable SEARCH mode, type [F1] and manually select the desired code.

G.3 AUTO SEARCH Performance

AUTO SEARCH works very well on most signals. However, it is also not infallible. A noisy or distorted signal may "trick" AUTO mode into choosing the wrong combination. If so, just type [F10] again to do another search.

AUTO SEARCH does not know when a signal has ended and a new type of signal should be decoded. Therefore, once SEARCH mode has selected a combination, PC-AMTOR will stay in that set of operating conditions until you again type [F10] and do another search. This prevents a random jumping between codes, modes, and rates during noise or during pauses in a transmission. This allows you to monitor all sides of a CW or RTTY QSO without having to re-enter a search after each amateur ends his transmission.

Some HF signals may sound like RTTY but AUTO SEARCH may not find a correct set of parameters. This can be especially true for signals outside the amateur bands where different codes or data rates may be used. Many of these "RTTY-like" signals are also encrypted. The PCI-3000 circuit board also has only one shift in its demodulator - 170 Hz, the standard for amateur use. 200 Hz shift signals from "multi-mode" devices will be accepted as if they were using 170 Hz shift, but 425 and 850 Hz shift commercial RTTY signals may not print well using PC-AMTOR and the PCI-3000. If you need to receive commercial RTTY, we suggest that you use the HAL PCI-2000 which is designed for these applications.

SEARCH acquisition of CW signals may take some practice since receiver tuning of CW and AMTOR/RTTY are for considerably different tones (CW at 800 Hz and AMTOR/RTTY at 2125/2295 Hz). The automatic mode switching required for SEARCH mode also switches the display scale on the SPT-2; you will only get a correct CW tuning indication when SEARCH mode is actively looking for a CW signal. For this reason, you may find it simpler to get used to CW reception by manually selecting CW rather than through SEARCH mode.

Once AUTO mode has selected a set of parameters, PC-AMTOR is then locked into that mode and has the same high-quality send and receive performance you would get if you had set the combination manually.

> *NOTE: PC-AMTOR remains in AUTO SEARCH mode until you use the Command Menu to select another mode.*

H. TUNING INDICATORS

PC-AMTOR is designed to give outstanding recovery of received AMTOR, RTTY, and CW signals. The demodulator hardware and software has been refined many times through 12 generations of HAL modem products. In most cases, our circuitry will print signals you cannot even hear. We think PC-AMTOR and the PCI-3000 include one of our best receive demodulator designs.

However, as good as our circuitry may be, it will not copy signals worth a "hoot" unless the signals are tuned-in correctly on your receiver. Accurate tuning may only be done if you have an accurate tuning indicator.

Several different tuning indicators may be used with PC-AMTOR. The following are what HAL recommends:

H.1 SPT-2 SPECTRA-TUNE

The SPT-2 SPECTRA-TUNE is designed to be used with PC-AMTOR and therefore offers the most complete tuning indicator package available for this product. It automatically changes modes to match those chosen in PC-AMTOR and gives reliable indication for all modes of PC-AMTOR.

H.1.1 AMTOR and RTTY Reception

When PC-AMTOR is set to AMTOR or RTTY, the SPT-2 tuning scale is automatically set for optimum AMTOR and RTTY indication. Also, if you have the FIL-1 filter accessory plugged into the SPT-2, the correct AMTOR/RTTY filter is also automatically selected. The SPT-2 "AMTOR/RTTY" LED will be ON when these modes are selected.

The AMTOR/RTTY tuning indicator scale shows the frequency of the received audio tones - from 1910 Hz to 2510 Hz. The center of the scale is at 2210 Hz, the mid-point between the standard RTTY Mark (2125 Hz) and Space (2295 Hz) frequencies. The Center, Mark, and Space frequencies are marked on the linear scale.

As you tune an AMTOR or RTTY signal, a "band" of LED segments will be illuminated, the lower end being "Mark" and the upper end "Space". Adjust receiver tuning so that this "Mark-Space Band" is centered around the "M" and "S" panel markings. Centering the illuminated "band" of LED segments always gives you the best receiver tuning adjustment, even if the other station is not sending the "correct" shift (170 Hz). A wider shift (200 Hz for example) will extend equally beyond both the "M" and "S" panel markings, but be equally balanced in the PCI-3000 RTTY filters.

> *NOTE: The above frequencies are correct for the standard U.S. model of PC-AMTOR, SPT-2, and FIL-1. The "export model" is set for a Mark tone of 1275 Hz and a Space tone of 1445 Hz. Use the same tuning procedure outlined above when tuning AMTOR or RTTY.*

H.1.2 CW Reception

Changing PC-AMTOR to CW automatically changes the SPT-2 tuning scale for a center frequency of 800 Hz. In CW, the tuning scale indicates audio frequencies from 500 Hz to 1100 Hz, with 800 Hz at center scale.

Tune the CW signal so that the center two LED segments at the "CW" center panel marking flash ON and OFF with the key-down state of the signal. The bandwidth of the PCI-3000 CW filter is approximately 200 Hz. This bandwidth also corresponds to the "M" and "S" AMTOR/RTTY markings on the SPT-2 frequency scale. The CW signal must be tuned so that it falls between the "M" and "S" marks to be copied by PC-AMTOR.

As an additional aid, the SPT-2 "CW" front panel LED flashes ON for each detected CW key-down condition. This provides additional information as to to how well the PCI-3000 CW modem is detecting the CW signal.

Also recall that PC-AMTOR includes a CW receive side-tone at 800 Hz that may be enabled by typing [Alt]-C. This can be a very accurate way to "fine-tune" CW reception - match the receiver tone frequency to that of the side-tone.

H.2 AMTOR/RTTY Tuning Scope

The PCI-3000 and SPT-2 also include separate "Mark" and "Space" scope outputs for connection to an external X-Y oscilloscope. HAL suggests that you connect "Mark" to the "X" scope input and "Space" to the "Y" input. The resulting pattern will be crossed-ellipses, familiar to all experienced AMTOR and RTTY operators. Correct tuning is achieved when the two ellipses are roughly perpendicular and each has maximum amplitude along its major axis (longest part of the ellipse). It is normal that the ellipses are not quite perpendicular.

Used properly, the X-Y oscilloscope is still the best tuning indicator for AMTOR and RTTY. It shows even the weakest signal and you can easily get to within a few Hz of "optimum" tuning. However, an X-Y oscilloscope can be expensive and the scope outputs give no information about tuning a CW signal. However, the CW receive side-tone of PC-AMTOR may still be used and is an accurate CW tuning indicator ([Alt]-C).

H.3 SPT-1 SPECTRA-TUNE

The previous HAL model SPT-1 SPECTRA-TUNE was designed to be used with the PCI-2000 product. However, care has been taken so that it may also be used with PC-AMTOR / PCI-3000. The SPT-1 and PCI-EXT cables and signals are directly compatible with the connectors and signals of the PCI-3000. However, the SPT-1 does not include automatic mode switch between AMTOR/RTTY and CW and does not include provision for the FIL-1 accessory. If you already own an SPT-1, by all means use it. However, the SPT-2 is recommended for all new installations.

This completes the OPERATOR'S GUIDE for PC-AMTOR. Please refer to the PC-AMTOR REFERENCE MANUAL for information concerning installation, use of Host Mode, and additional technical details.

SPT-2

SPECTRA-TUNE TUNING INDICATOR

INSTRUCTION MANUAL

HAL COMMUNICATIONS CORP.
BOX 365
URBANA, ILLINOIS 61801

QUALITY COMMUNICATIONS EQUIPMENT

SPT-2

SPECTRA-TUNE

TUNING INDICATOR

for the

HAL PCI-3000 / PC-AMTOR HF DATA MODEM

870-00002

January, 1990 Printing

SPT-2 SPECTRA-TUNE MANUAL

CONTENTS:

FIGURES:

CHAPTER 1
INTRODUCTION

The SPT-2 SPECTRA-TUNE is a tuning indicator specifically designed for use with the HAL PCI-3000 / PC-AMTOR product. The frequency spectra of the received signal is displayed on a calibrated linear 30-segment bar graph. The center of the frequency scale is automatically set by the PCI-3000 to 800 Hz for CW reception or 2210 Hz for AMTOR and RTTY (1360 Hz for export version). Up to 5 Hz tuning resolution may be achieved using the SPT-2. Front panel LEDs indicate AMTOR/RTTY or CW mode and CW key down state.

The SPT-2 is powered and controlled by the PCI-3000 through the included mating cable. The rear panel of the SPECTRA-TUNE provides convenient "RCA-style" connectors for all radio connections. In addition, the SPT-2 includes a separate rear panel "Host Port" DB-25S connector.

Although designed specifically for the PCI-3000, the SPT-2 is also directly compatible with the HAL PCI-2000 with the exception that the PCI-2000 will not control automatic scale and mode switching in the SPT-2.

The FIL-1 accessory is available for the SPT-2. The FIL-1 is a circuit board filter that plugs into the the SPT-2 and provides additional filtering for AMTOR and RTTY reception.

Your SPT-2 SPECTRA-TUNE includes the following materials:

1 - 900-00002 SPT-2 SPECTRA-TUNE
1 - 870-00002 SPT-2 MANUAL
1 - 855-00006 Cable, SPT-2 to PCI-3000

Carefully inspect your SPECTRA-TUNE shipping carton for evidence of shipping damage. Any damage should be immediately reported to your shipping carrier. Be sure to save any damaged packing materials as the carrier will have to inspect those if you have a claim. Note that a damage claim must be filed with the shipping carrier - NOT HAL Communications. HAL will of course be glad to assist in such cases, but it is only the shipping carrier who can pay damage claims.

Check to be sure that all of the materials listed above are contained in your SPECTRA-TUNE package. If you find any materials missing, please contact your dealer or HAL Communications as soon as possible.

CHAPTER 2
INSTALLATION

The SPT-2 SPECTRA-TUNE serves as both a tuning indicator and the main connection box between the PCI-3000 and your radio equipment. The SPT-2 also provides an RS-232 connector for the PCI-3000 Host Port.

2.1 FIL-1 Installation

The SPT-2 also houses the FIL-1 accessory filter. If you have purchased the FIL-1, install it before connecting the SPT-2 to your PCI-3000.

1. Turn the SPT-2 cabinet upside down and remove the two recessed screws. Be sure to save the screws!

2. Holding top and bottom covers together, place the SPT-2 right-side up so that the front panel faces you. Remove the top cover.

3. The SPT-2 contains three circuit boards: (1) front panel, (2) rear panel, and (3) "main" horizontal circuit board. Note the large "blank" area to the left side of the "main" circuit board.

4. Locate circuit board plug J4. Note that a 2-circuit jumper plug is installed between J4 pins 1 and 2. Remove and save this jumper. This jumper plug is required if the FIL-1 board is not installed. You might wish to tape the jumper plug inside the top lid of the SPT-2 cabinet.

5. Note the two threaded posts behind the AMTOR/RTTY and CW LED's. Remove and save the 4-40 screws and lock washers from the two threaded posts.

6. Un-wrap the FIL-1 circuit board. Note that the FIL-1 J2 plug mates with plug J4 on the SPT-2 main circuit board. Plug the FIL-1 board into the SPT-2.

7. Fasten the FIL-1 board using the screws and lock washers removed in step 5.

8. If you are using the SPT-2 with the HAL PCI-2000, you may wish to read section 2.3 to choose a CW KEY jumper position before continuing. It is not necessary to make a CW Key polarity adjustment if you are using the PCI-3000 / PC-AMTOR.

9. This completes installation of the FIL-1 accessory. Replace the top cover and screws removed in step 1.

2.2 Radio Connections

Radio connections are described in Section 2.5.2 of the PCI-3000 REFERENCE MANUAL and in Figure 2.2 of that manual. That diagram is reproduced as Figure 1 of this manual. Host Port connections and cable requirements are discussed in Chapter 4 of the PCI-3000 REFERENCE MANUAL.

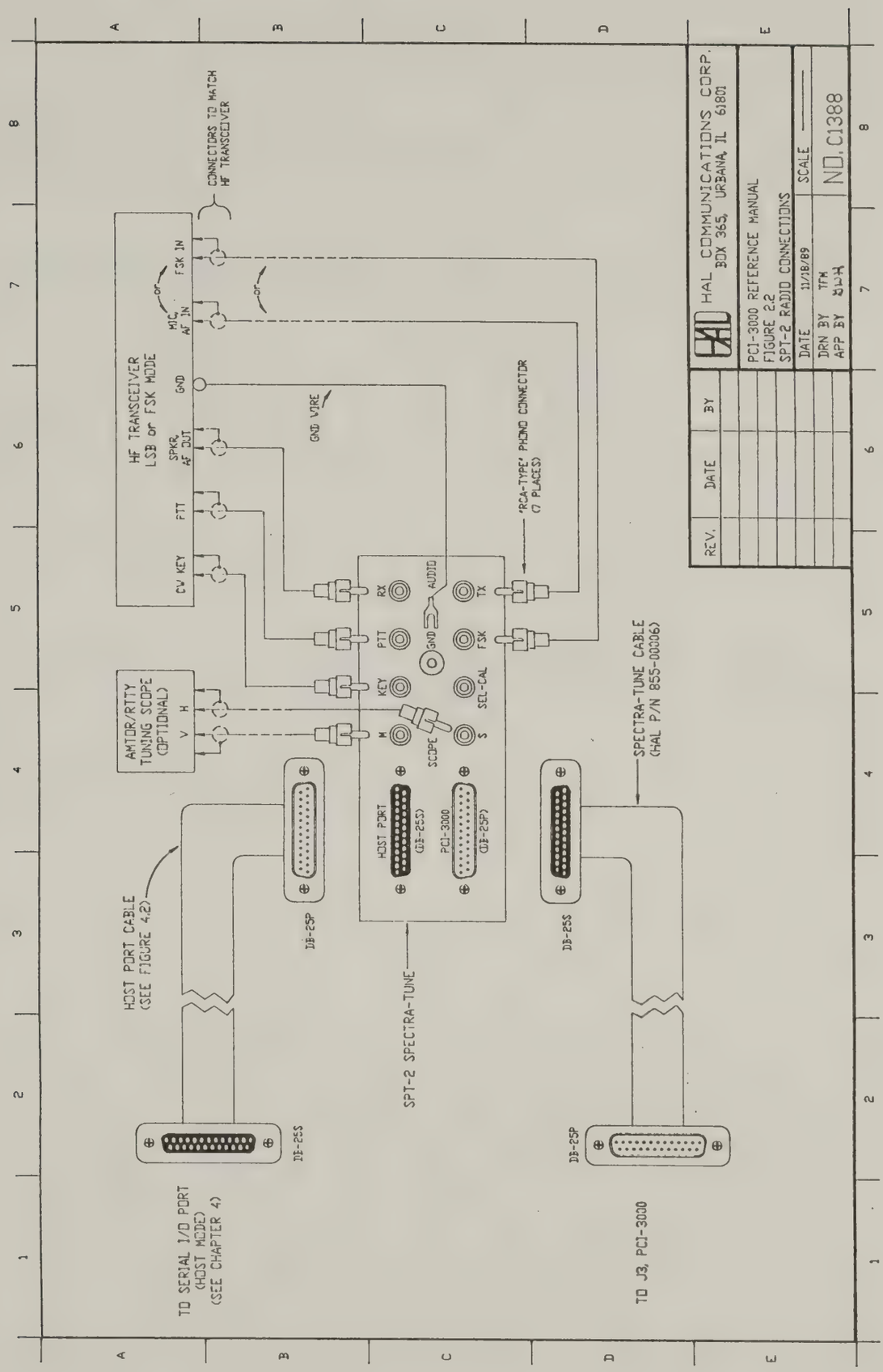

Figure 1. SPT-2 Radio Connections

2.3 Use of the SPT-2 with the PCI-2000

The SPT-2 may be used with either the PCI-3000 (PC-AMTOR) or the HAL PCI-2000. However, there are a few differences when using the PCI-2000. These are:

1. The PCI-2000 has separate CW keyer stages for positive and negative CW key circuits. You must set the proper polarity inside the SPT-2 at Jumper J1 (see Figure 6). Most modern transceivers use positive polarity and this is the factory default setting.

   The PCI-3000 does *not* use a polarized CW keying circuit and may be used to key either positive or negative voltages. It is not necessary to change jumper J1 when the PCI-3000 is used.

2. The PCI-3000 automatically switches the frequency scale when AMTOR/RTTY or CW are selected (2210 Hz center for AMTOR and RTTY, 800 Hz for CW). The PCI-2000 does not include this automatic feature. However, the RTTY/CW mode of the SPT-2 can be switched by manual control of the PCI-2000 "KY1" output signal.

3. The PCI-2000 does not provide a CW LED output signal. The SPT-2 front panel LED will therefore not operate when the SPT-2 is used with the PCI-2000.

4. The PCI-2000 "KY2" output signal is connected to the SPT-2 "SEL-CAL" rear panel connector. This signal operates exactly as indicated in the PCI-2000, controlled by the [Ctrl]-[F10] keys in PC-RTTY.

5. The SPT-2 is designed to support only 170 Hz shift AMTOR and RTTY. The frequency scale is <u>not</u> calibrated for 425 and 850 Hz shift RTTY signals. The SPT-1 is more suitable if wide shift reception is required.

2.4 Export Version

The SPT-2 and PCI-3000 are available in two versions - U.S. and export. The U.S. version is designed for use with U.S. standard AMTOR and RTTY tones centered at 2210 Hz (2125 Mark and 2295 Space). The export version supports AMTOR and RTTY tones centered at 1360 Hz (1275 Mark and 1445 Space). The only difference between the two versions is the placement of Jumper J3 on the SPT-2 "main" circuit board (see Figure 6) and J1 on the FIL-1 circuit board (see Figure 10). Both jumpers should be installed for "U.S. Tones" and removed for "Export Tones". An SPT-2 may be converted from one to the other tone set by making the appropriate jumper change <u>and</u> re-aligning control R1 on the "main" board and R9 on the FIL-1 board. These adjustments are discussed in Chapter 5.

Both U.S. and Export versions are available from the factory. All "Export" versions will have "LOW TONES" clearly marked on a tag on the <u>bottom</u> of the SPT-2 cabinet.

CHAPTER 3
OPERATION

Operation of the SPT-2 is very simple. All calibration and control of the tuning indicator is automatically done by the PCI-3000 hardware and by PC-AMTOR software. As noted in Section 2.3, some manual control is necessary when the SPT-2 is used with the PCI-2000.

To use the SPT-2, make all connections shown in Figure 1 and run PC-AMTOR in your PC. The AMTOR/RTTY LED will be ON whenever PC-AMTOR is set to an AMTOR or RTTY mode. This LED turns OFF when CW mode is chosen. In addition, when CW signals are detected, the CW LED will flash ON and OFF (ON = key down).

3.1 Tuning AMTOR and RTTY Signals

The front panel tuning display has 30 LED bar segments. The total frequency range of the display is 600 Hz, 20 Hz per segment. However, as the input frequency changes, the transition between two illuminated bars is gradual. It is therefore relatively easy to obtain visual frequency resolution of the order of 5 Hz or less.

The center of the AMTOR/RTTY tuning scale represents 2210 Hz, the mid-frequency between the standard Mark at 2125 Hz and Space at 2295 Hz. A correctly tuned 170 Hz shift AMTOR or RTTY signal will show bright illumination of the LED bars near the front panel "M" and "S" labels.

> *NOTE: Export versions are calibrated for 1360 Hz center scale with Mark at 1275 Hz and Space at 1445 Hz.*

Note the "+" and "-" labels below the display. If receiver tuning is set "too high", the RTTY Mark/Space signal will illuminate bars to the right of center scale. You should therefore adjust receiver tuning so that *lower pitch* tones are received. Similarly, if the AMTOR/RTTY signal is on the left end of the scale, adjust tuning to increase the pitch of the received tones.

Some AMTOR and RTTY signals are not sent using the correct 170 Hz Mark-Space shift. The PCI-3000 and SPT-2 may be used with these signals by tuning the receiver so that the Mark and Space LED signals are still centered on the display - adjust for an equal "error" between the "M" and "S" labels. A "too wide" shift will cause LED segments above and below the "M" and "S" labels to be illuminated. The shift of the other station is easily seen on the SPT-2 scale. AMTOR FEC and RTTY signals tune exactly the same way.

CORRECT AMTOR/RTTY TUNING IS ALWAYS CENTERED ON THE "M" AND "S" LABELS.

Noise and interference may distort or "smear" the SPT-2 indication. Narrow receive filters will give improved tuning indications when QRM is heavy. A narrow receive filter may also improve display of noisy and weak signals. If your desired signal is fading, adjust tuning when the signal is strong and then *do not retune* during fades.

Tuning AMTOR ARQ mode signals may require some practice. ARQ mode signals may be either "ISS" (Information Sending Station) or "IRS" (Information Receiving Station). The ISS signals have a "long" pulse length (210 ms) and are relatively easy to tune using the SPT-2. An IRS signal, however, is a short pulse (70 ms) and therefore does not illuminate SPT-2 indicators bars for very long at a time. Careful tuning is required when tuning an IRS signal.

Typical AMTOR and RTTY tuning indications are shown in Figure 2.

3.2 Tuning CW Signals

When the CW mode is selected in the PCI-3000, the SPT-2 is also automatically set to CW mode. This changes the frequency scale so that the CW "center frequency" is 800 Hz (same for U.S. and export versions). The total tuning range of the scale remains 600 Hz, so the display range in CW mode is 500 Hz to 1100 Hz (800 ± 300 Hz). As in the case for RTTY, a visual resolution of 5 Hz or better is easily achieved. A received CW signal produces a single ON/OFF flashing LED that shows the received tone pitch.

To receive CW, set the receiver or transceiver to "CW MODE" and tune so that the LED bar at the "CW" panel label flashes ON and OFF with the received code. The front panel "CW" LED will also flash ON and OFF when the signal is properly tuned. This LED is driven by the *detector* stage of the PCI-3000. If it is flashing correctly, you therefore know that the signal matches the filters of the PCI-3000 CW receive hardware.

The PCI-3000 also includes a CW receive audio side-tone that may be enabled (or disabled) by typing [Alt]-C. This side-tone is set to exactly 800 Hz. Correct tuning may also be achieved by adjusting the received CW tone pitch to match the frequency of the side-tone. Like the SPT-2 "CW" LED, the side-tone is driven by the PCI-3000 detector circuitry. It will not sound until tuning is "close".

As in the case for AMTOR and RTTY, CW tuning indications may be distorted by noise or interference. These conditions may be reduced somewhat by using the narrow receiver filter (if available). However note that, while a narrow receiver filter may improve CW tuning indications, it may also *degrade* actual decoding of the CW signal itself due to filter "ringing". *Use a receiver narrow filter only if absolutely necessary!* A filter that helps your "ear copy" may seriously degrade computer CW reception.

Typical CW tuning displays are also shown in Figure 2.

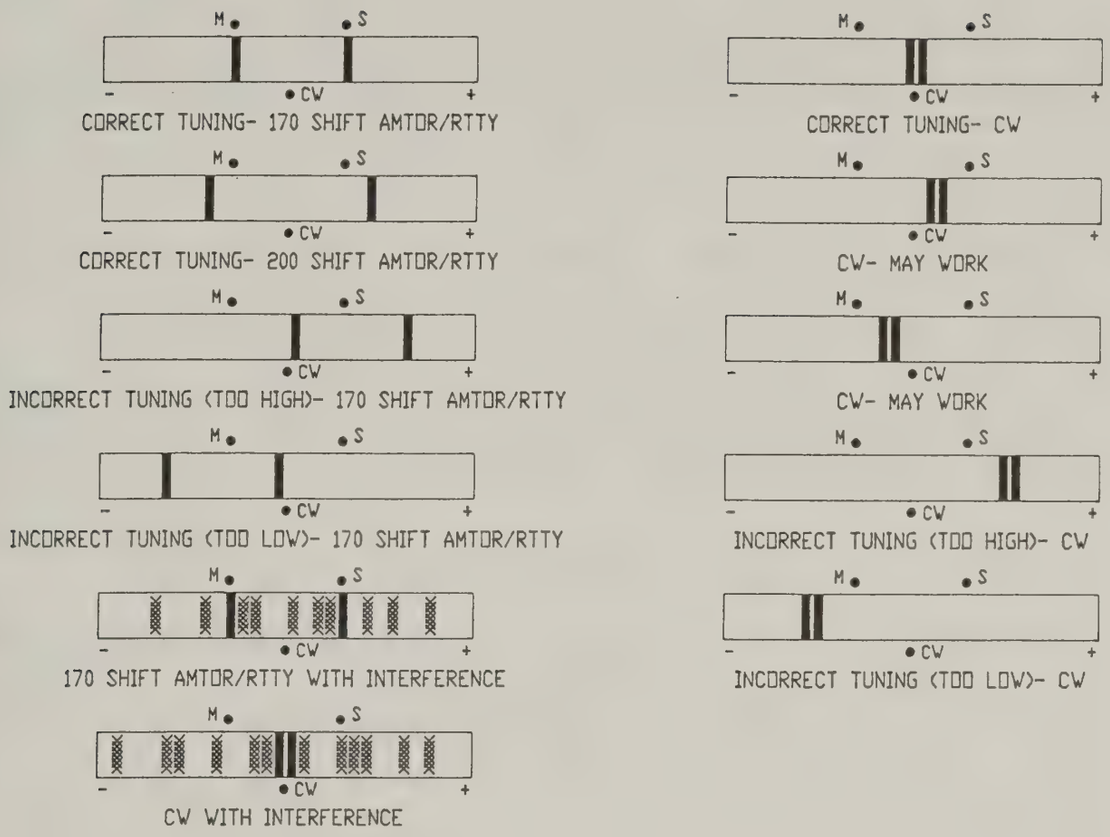

Figure 2. Typical Tuning Indications

3.3 FIL-1 Filter Accessory

The FIL-1 accessory provides additional audio selectivity for AMTOR and RTTY reception. The FIL-1 is automatically by-passed when in CW mode. This is intentional to prevent filter "ringing" and decoding errors caused by a narrow CW filter. The signal to the SPT-2 tuning indicator is *not* filtered by FIL-1 so that the full spectrum of received tones may be displayed.

The FIL-1 center frequency is set to 2210 Hz (1360 Hz for export models), and has a -6 dB bandwidth of approximately 500 Hz. The filter itself has very steep skirts, giving excellent off-channel rejection. It is automatically selected each time the PCI-3000 is set to any AMTOR or RTTY mode. The FIL-1 may greatly improve AMTOR and RTTY reception, but is not a total replacement for a good narrow IF filter in the receiver itself; having both the FIL-1 and a good receiver filter is generally the best approach.

CHAPTER 4
TECHNICAL DESCRIPTION

The SPT-2 SPECTRA-TUNE is constructed on three circuit boards: (1) Rear panel board, (2) Main circuit board, and (3) Display circuit board. The FIL-1 accessory is constructed on a fourth circuit board that plugs into the "Main" circuit board. All circuit boards plug into each other and are contained within the SPT-2 cabinet. The schematics and parts placement diagrams for these circuit boards are shown in Figures 3 through 10. The following discussion references these diagrams.

4.1 SPT-2 Rear Panel Assembly (Figures 3 and 4)

The rear panel assembly provides connectors and signal routing as follows:

1. J3 to the PCI-3000. All signals to and from the radio, host port signals, and power and control signals to the SPT-2 pass through this connector. J3 is a DB-25P connector ("male" pins).

2. J1 for host port. J1 pin connections on the SPT-2 conform to standard RS-232 DCE connections. J1 is a DB-25S connector ("female" sockets).

3. J4 through J11 for radio connections. Separate connectors are provided for each radio signal connection to the PCI-3000. Each connector is a standard 1/4" RCA-type phono connector. Each radio connection is by-passed to ground to eliminate radio frequency interference.

4. J2 to the SPT-2 Main circuit board. The power, audio signals, and control signals for the SPT-2 pass through this connector. Also, audio signals and control for the FIL-1 pass through J2.

4.2 SPT-2 Main Circuit Board (Figures 5 and 6)

The SPT-2 frequency sensing circuits are located on the Main circuit board. Receive audio from the rear panel circuit board (J1, pin 5) drives limiter stage U1a. This stage removes amplitude variations in the received signal. Balance control R7 is adjusted for symmetrical clipping at TP1.

The amplitude limited received signal drives stage U2, a "frequency-to-voltage converter". The output of this stage (U2, pin 10) is a DC voltage that varies with the average frequency of the input signal.

The DC output signal is then level shifted in stage U1b and amplified by U1c. The output of U1c (pin 8) then drives the front panel display via J5, pin 2.

Control R1 sets the RTTY center scale calibration (2210 Hz) and control R13 sets the full scale bandwidth (600 Hz). When CW mode is selected in the PCI-3000, transistor Q1 switches control R2 in parallel with R1. R2 sets the CW scale center frequency (800 Hz). Note that RTTY (R1) must be adjusted before CW (R2). The scale (R13) is the same for both RTTY and CW modes.

Jumper J3 is normally installed for all U.S. versions of the SPT-2. However, for export versions, jumper J3 is removed and R1 adjusted for the new RTTY center scale frequency (1360 Hz).

Jumper J2 is used for CW transmit key polarity selection when the PCI-2000 is used with the SPT-2. When used with the PCI-2000, set this jumper to match the keying voltage of your transmitter.

NOTE: The PCI-3000 will switch either a positive or negative voltage CW keying circuit. Jumper J2 may be set to either position when the PCI-3000 is used with the SPT-2. J2 is set at the factory to the "+" position.

Voltage regulators VR1 and VR2 stabilize and filter the PC +12V and -12V power voltages provided via the PCI-3000.

If used, accessory filter FIL-1 plugs into connector J4. Audio IN, Audio OUT, CW/RTTY control signal, and ± 8V power are supplied via J4. If the FIL-1 is not used, a two-pin jumper plug must be installed between pins 1 and 2 of J4. This jumper plug is installed in all new SPT-2 units and must be removed when installing the FIL-1.

4.3 SPT-2 Display Circuit Board (Figures 7 and 8)

This circuit board contains the LED bar indicators, their driver IC's, and the two front panel LED lamps. The display uses three 10-segment LED bar graphs (U4 through U6), each driven by LM3914 driver stages (U1 through U3). The display is essentially a linear DC voltmeter that displays the voltage output of the Main circuit board (via J1, pin 2).

LED DS1 is ON when the PCI-3000 is in AMTOR or RTTY mode. DS2 turns ON whenever the PCI-3000 is CW mode and its CW receive detector senses a key-down signal condition (CW tone ON).

4.4 FIL-1 Circuit Board (Figures 9 and 10)

The FIL-1 circuit board plugs onto the SPT-2 Main circuit board. All signals and power requirements are provided via connector J2. As noted in 4.2, the jumper plug in the Main board J4 must be removed to install the FIL-1.

The PCI-3000 RTTY or CW control signal (J3, pin 3) switches the DPDT IC switch U5. When the PCI-3000 is in CW mode, the receive audio signal by-passes the filter and passes from pin 2 to pin 1 of J2.

When the PCI-3000 is in AMTOR or RTTY mode, the receive audio signal drives low-pass filter stage U2b. This 2-pole active filter removes any high-frequency components that might otherwise cause "aliasing" in the Bandpass filter stage (U3). The low-pass cut-off frequency is approximately 3000 Hz.

The primary filter stage is IC U3, a SCF (Switched Capacitor Filter). This stage is a 6-pole, Chebychev ANSI Class II, 1/3 Octave bandpass filter. The center frequency is set to 2210 Hz. The -6 dB bandwidth is approximately 500 Hz.

NOTE: The U.S. version of the FIL-1 uses an R5614 IC at U3. The export version uses a type R5615 IC at U3. The export center frequency is 1360 Hz, with a -6 dB bandwidth of approximately 500 Hz.

The output of the SCF stage (pin 2) is again filtered by a 2-pole active LPF (U4). This stage removes the high frequency switching signal from the SCF output. LPF U4 is identical to stage U2 and also has a cut-off frequency of 3000 Hz.

The SCF center frequency is set via clock oscillator U1, adjusted with control R9. The SCF clock frequency at TP1 is approximately 54 times the desired filter center frequency. For the U.S. version, the clock frequency is 119,340 Hz. Jumper J1 is installed for the U.S. version and removed in the export version. The export version clock frequency is 73,400 Hz.

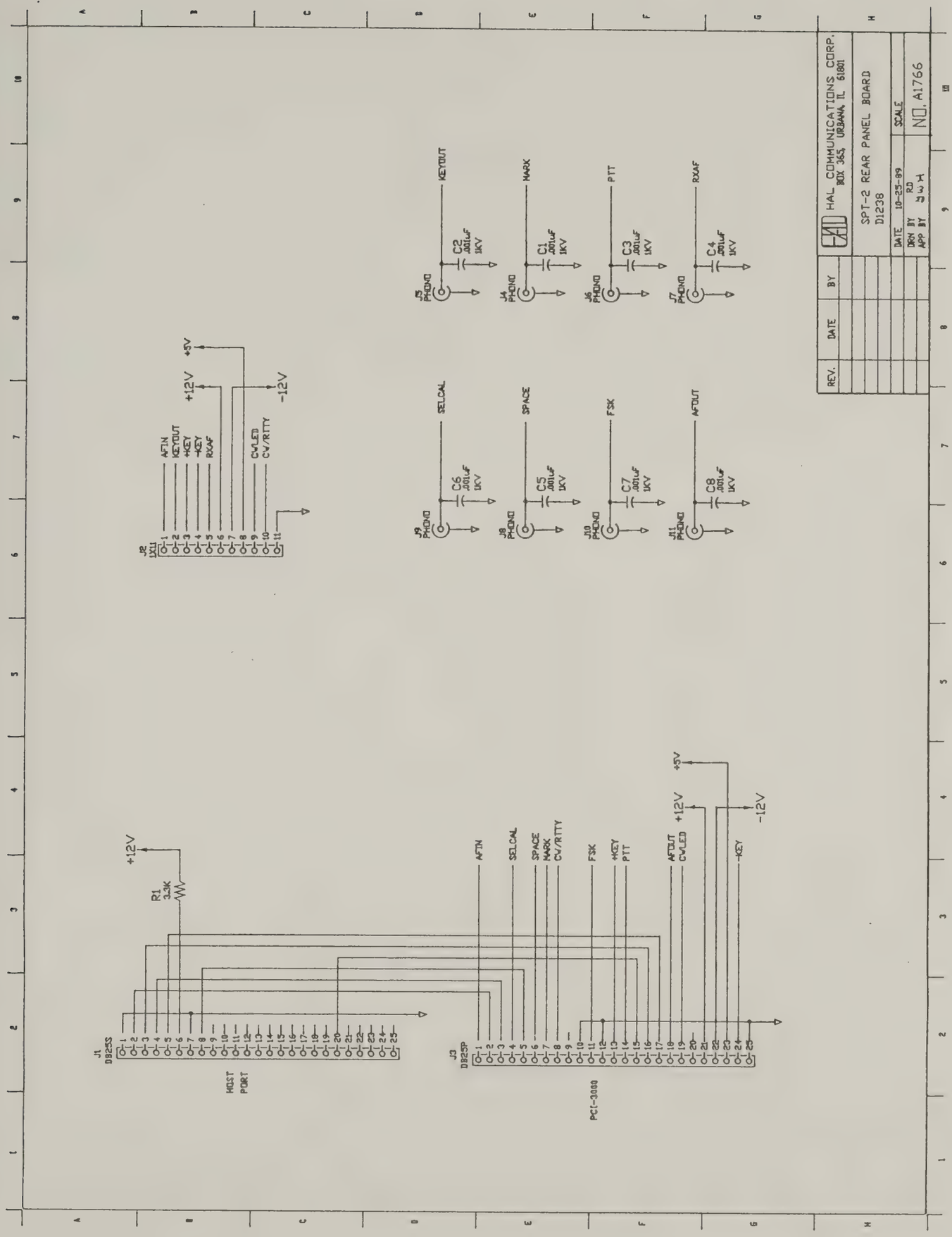

Figure 3. SPT-2 Rear Panel Circuit Board Schematic

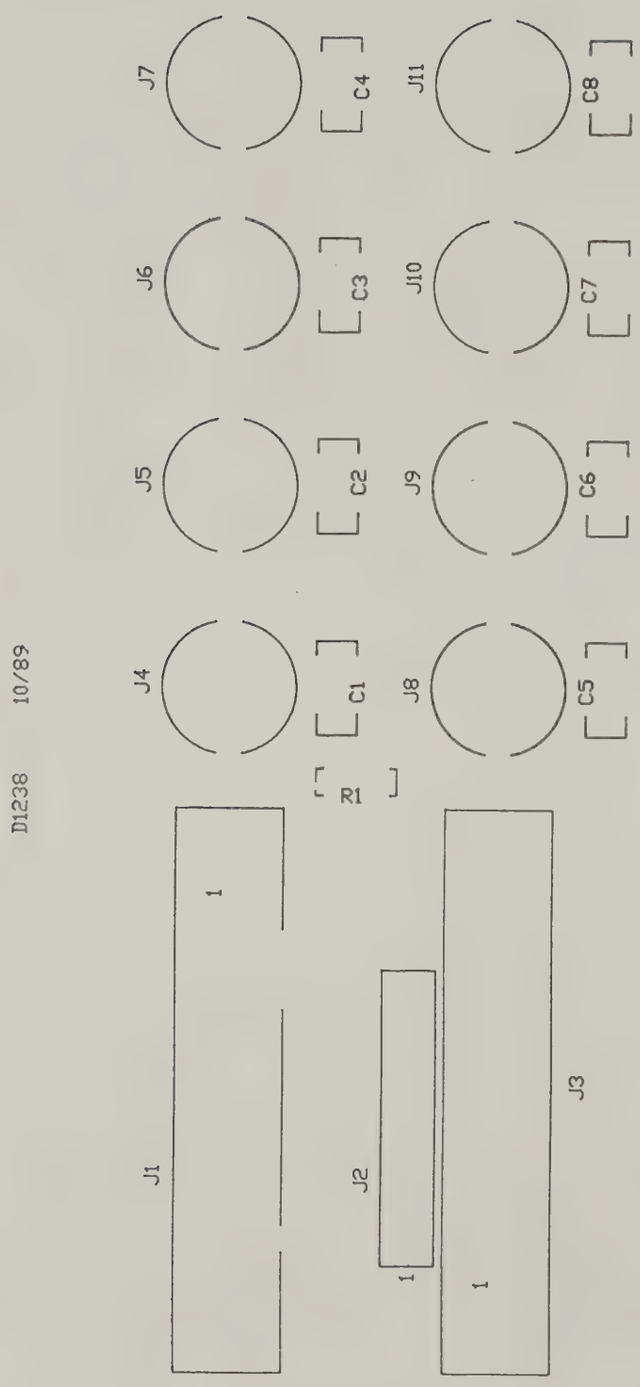

Figure 4. SPT-2 Rear Panel Circuit Board Parts Placement

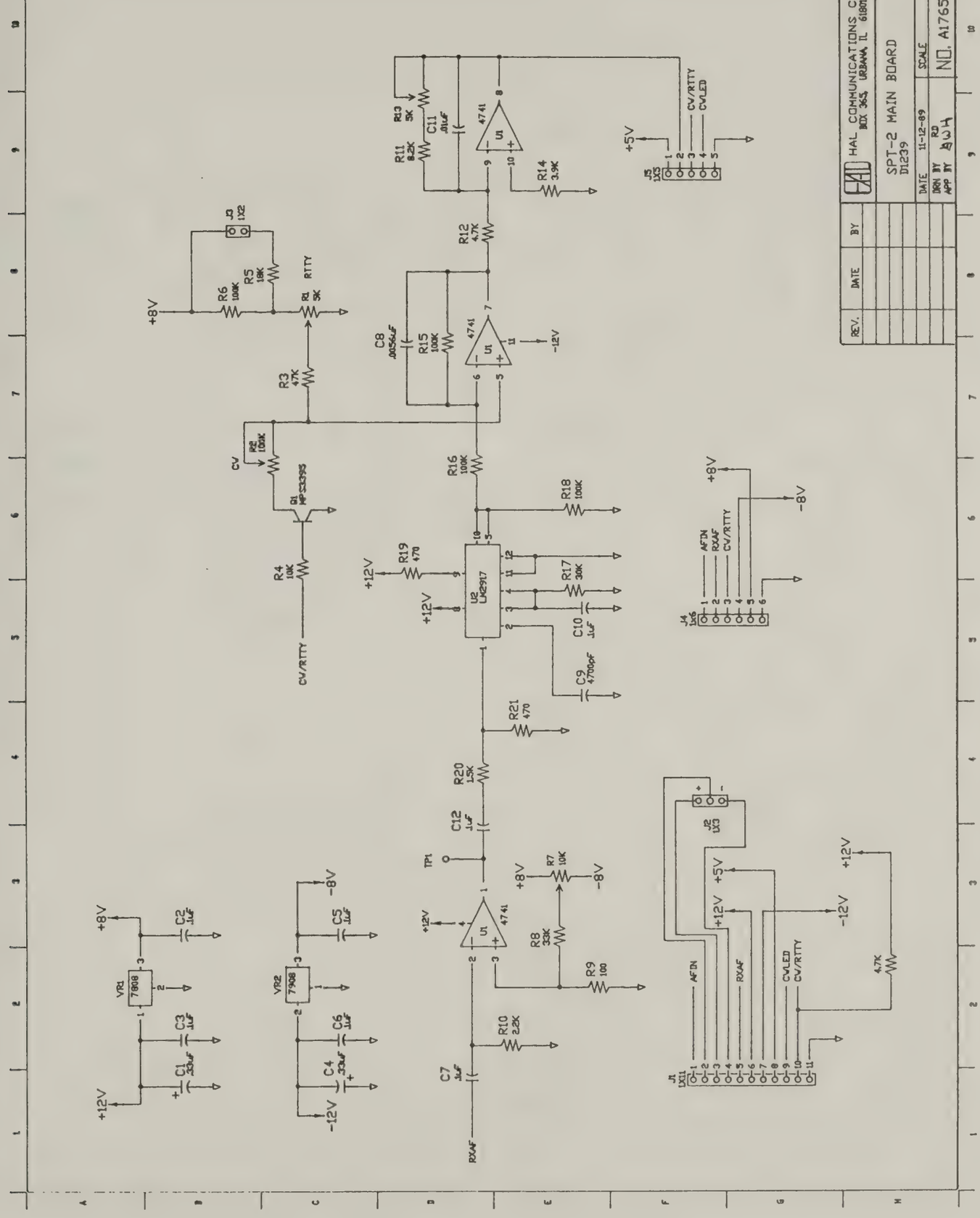

Figure 5. SPT-2 Main Circuit Board Schematic

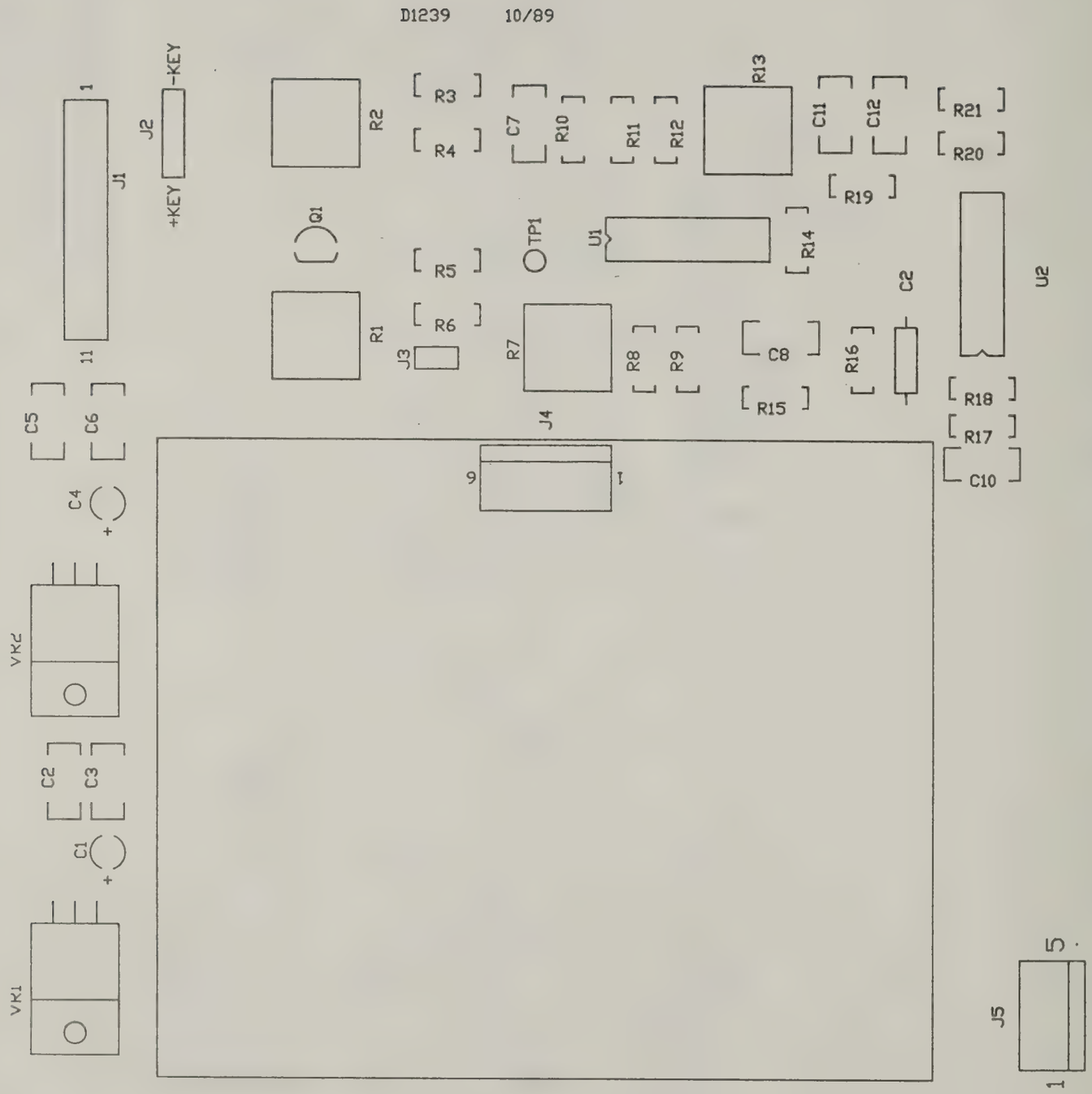

Figure 6. SPT-2 Main Circuit Board Parts Placement

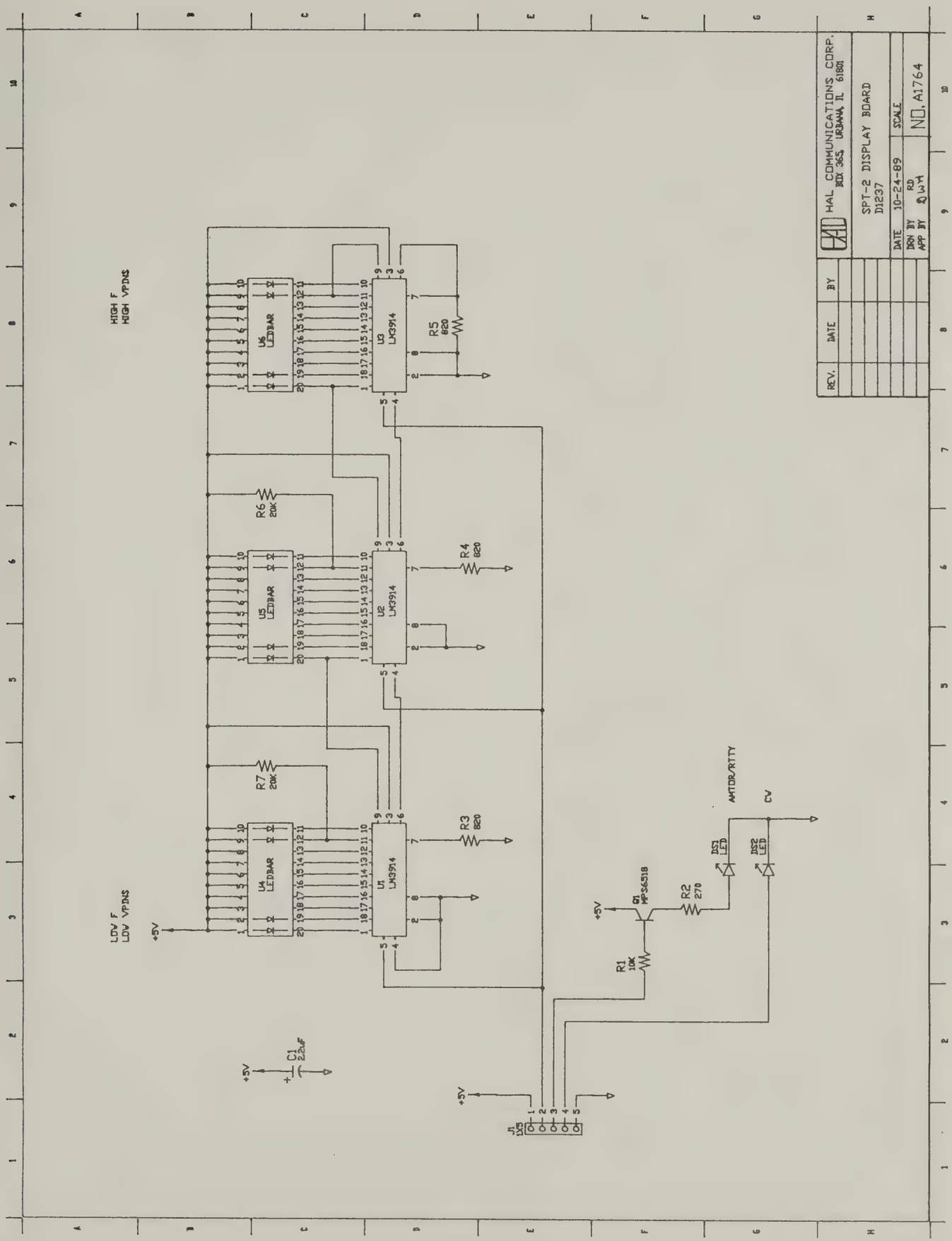

Figure 7. SPT-2 Display Circuit Board Schematic

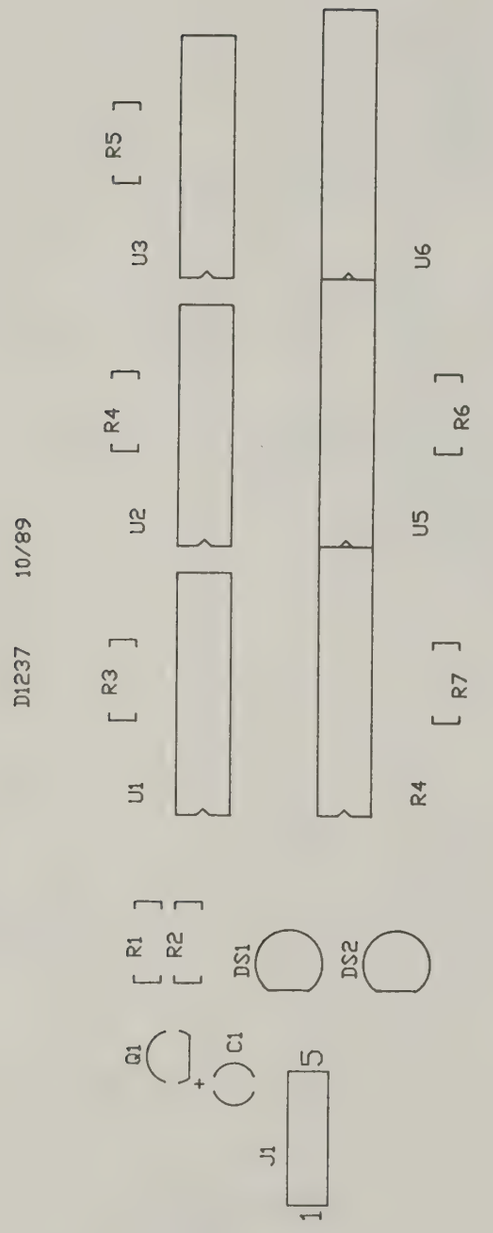

Figure 8. SPT-2 Display Circuit Board Parts Placement

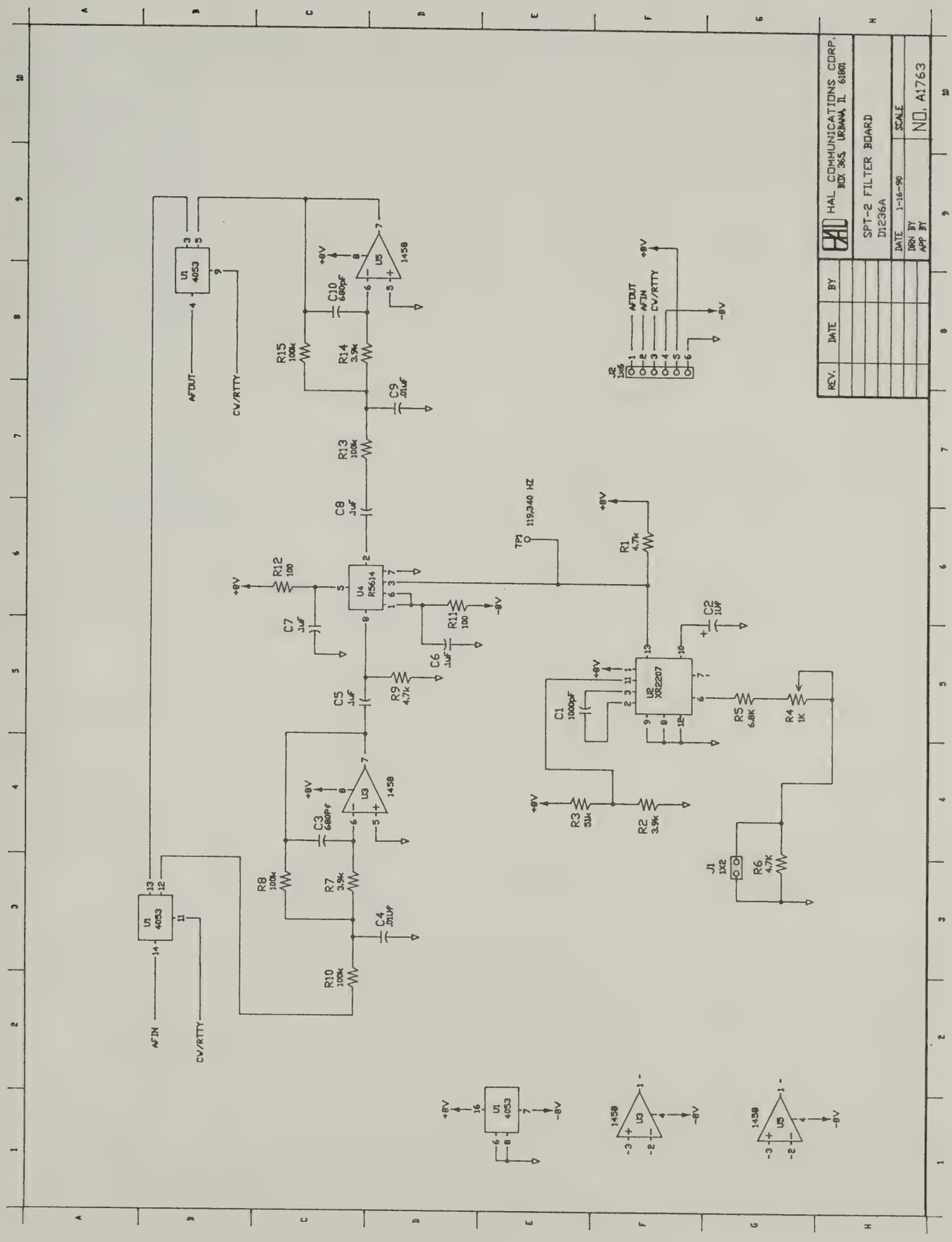

Figure 9. FIL-1 Circuit Board Schematic

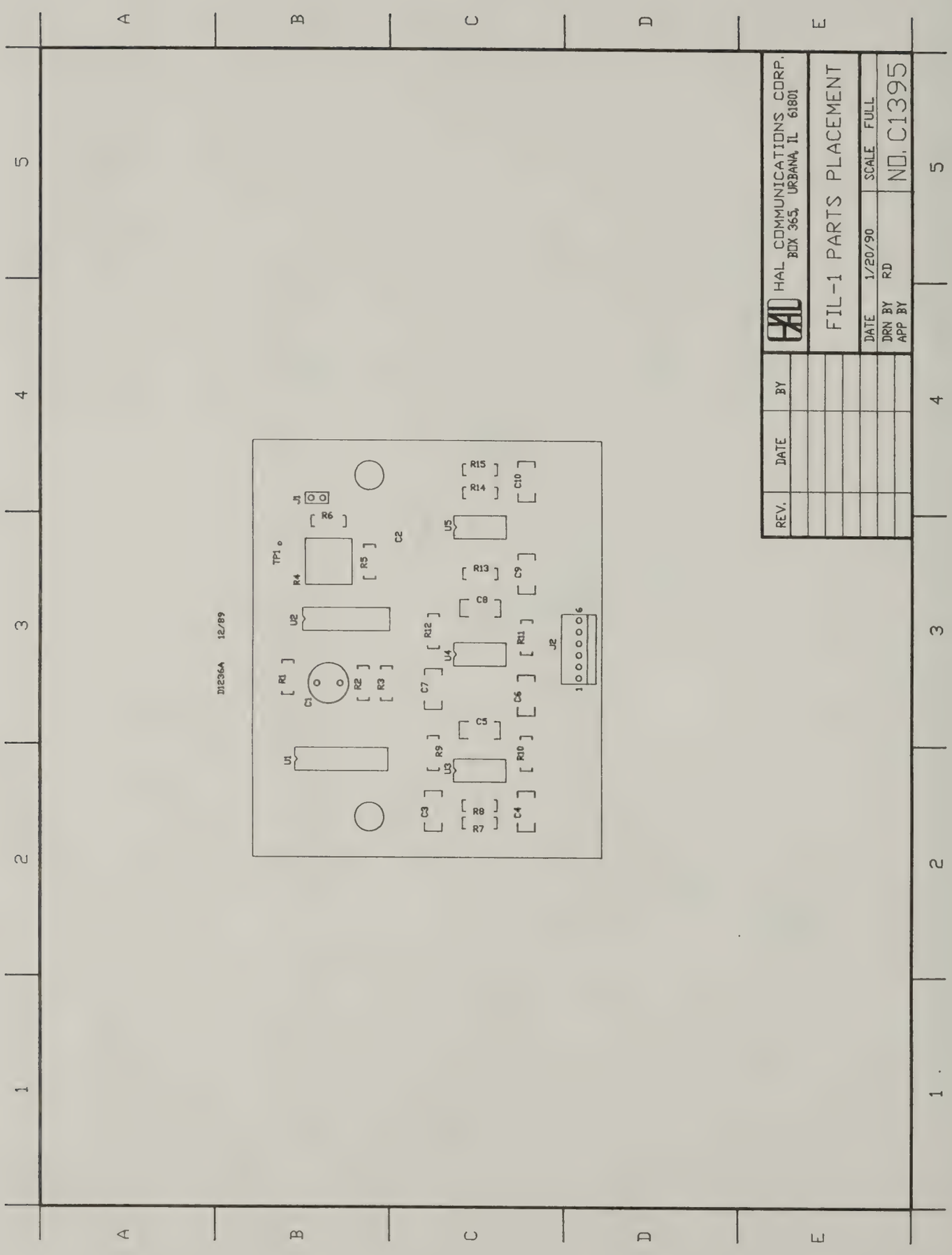

Figure 10. FIL-1 Circuit Board Parts Placement

CHAPTER 5
ALIGNMENT

The SPT-2 is a stable device and frequent testing or re-alignment should not be necessary. However, if alignment should be necessary, please follow these simple instructions.

A minimum of test equipment is necessary. An audio generator, frequency meter, and oscilloscope are all that are really required. *See Chapter 6 of the PCI-3000 REFERENCE MANUAL for a complete list of recommended equipment.*

Please refer to the schematic and parts placement drawings of the previous section to locate controls and test points. The following assumes that the SPT-2 is connected to the PCI-3000 and that PC-AMTOR is used to control the PCI-3000.

5.1 AMTOR and RTTY Alignment (Main board, Figures 5 and 6)

1. Connect an oscilloscope to TP1 and the audio generator to the SPT-2 rear panel "RX AUDIO" connector. Set the audio generator to 2210 Hz and the output level to -30 dBm. Set the PCI-3000 to RTTY mode. The SPT-2 AMTOR/RTTY LED should be ON and the CW LED OFF.

2. Adjust control R7 for symmetrical clipping of the positive and negative peaks of the audio signal. Adjust the audio signal amplitude so that the signal is just barely clipped. Trim R7 if necessary. This "limiter threshold" should occur at a level of -30 dBm ± 5 dB.

3. Set the audio generator to 2125 Hz (1275 Hz for export) and -10 dBm amplitude. View the front panel display and adjust control R1 so that only one segment under the "M" panel label is turned ON.

   NOTE: Jumper J3 must in <u>installed</u> for U.S. versions and <u>removed</u> for export versions.

4. Change the audio generator frequency to 2295 Hz (1445 Hz for export) and -10 dBm amplitude. View the front panel display and adjust control R13 so that only one segment under the "S" panel label is turned ON.

5. Check the AMTOR/RTTY "end-point" calibration by adjusting the audio generator frequency. The "low end" of the scale should be approximately 1910 Hz; the "high-end" should be approximately 2510 Hz (1060 to 1660 Hz for export). These are only check numbers, the important calibrations are those done in steps 3 and 4.

(FIL-1 Board, Figures 9 and 10)

6. Connect the frequency counter to TP1 on the <u>FIL-1</u> circuit board. Adjust control R9 <u>on the FIL-1 board</u> for a frequency of 119,340 Hz (73,440 Hz for export).

This completes RTTY alignment of the SPT-2.

5.2 CW Alignment (Main Board, Figures 5 and 6)

7. Set the audio generator to 800 Hz and -10 dBm output. Use PC-AMTOR to set the PCI-3000 to CW mode.

8. Viewing the front panel, adjust control R2 so that the center two LED bars at the "CW" panel label are both ON. Do not re-adjust R1 or R13 from their previous settings.

9. The front panel CW LED should be ON whenever the audio generator frequency is between the "M" and "S" panel labels. The CW LED should be OFF above and below these points. (The CW receive side-tone will also switch ON and OFF at the same frequencies).

This completes all alignment of the SPT-2 SPECTRA-TUNE and the FIL-1 RTTY FILTER accessory.

CHAPTER 6
SPECIFICATIONS

SPT-2 SPECTRA TUNE

AUDIO INPUT:	-30 to +10 dBm (30 mV to 3 V rms) 500 Hz to 2500 Hz; from receiver
CW SCALE:	500 Hz to 1100 Hz, centered at 800 Hz
AMTOR/RTTY SCALE:	1910 Hz to 2510 Hz, centered at 2210 Hz [export: 1060 - 1660 Hz; 1360 Hz center]
DISPLAY:	30-segment LED bar; 20 Hz per segment; 5 Hz visual resolution.
MODE INDICATORS:	AMTOR/RTTY LED CW LED keyed by detected CW signal
DATA CONNECTIONS:	DB-25P to PCI-3000 DB-25S for "Host Port" control of PCI-3000
RADIO CONNECTIONS:	8 "RCA-type" phono connectors: Receiver Audio Output Transmitter Audio Input Push-To-Talk Control FSK Transmit Data AMTOR SEL-CAL Output CW Transmit Key Output Mark/Space RTTY Scope Outputs
POWER SOURCE:	PCI-3000 Circuit Board
CABLE:	6 foot DB-25S to DB-25P Cable
MECHANICAL:	6.25" x 2.5" x 6.25" (15.87x6.35x15.87 cm) "PC Ivory" Plastic Enclosure 1.0 lb net, 3 lbs shipping (.45 & 1.35 kg)

FIL-1 RECEIVE FILTER ACCESSORY

COMPATIBILITY:	Plug-in card, user-installed inside SPT-2; Powered and controlled by PCI-3000 and SPT-2
CENTER FREQUENCY:	2210 Hz (U.S.) or 1360 Hz (Export)
-6 dB BANDWIDTH:	500 Hz (U.S. and export)
MODES	AMTOR and RTTY (CW by-passes filter)
MECHANICAL:	3.0" x 3.6" circuit board (7.6x9.1 cm) .5 lbs net, 1.0 lbs shipping (1.1 & 2.2 kg)

LIMITED WARRANTY

HAL Communications Corp. of Urbana, Illinois, hereby warrants to the purchaser that the product herein described shall be free from defects in materials and workmanship, and from failure of operation from ordinary use, for a period of one year from the date of sale to the purchaser.

In the event of a defect in materials or workmanship during the warranty period, HAL Communications Corp. will, at its own expense, repair the defective unit and replace any defective parts. Cost of shipping the unit to HAL Communications Corp. as well as costs of removal and reinstallation of the unit shall be paid by the purchaser. HAL Communications Corp. will pay the shipping costs incurred in returning the unit to the purchaser.

To obtain warranty service, the customer should:

1. Notify, as soon as possible, the Customer Service Department of HAL Communications Corp., Box 365, Urbana, Illinois, 61801, of the existence of a possible defect.

2. At the time of notification, identify the serial number, and the possible defect.

3. HAL Communications will issue a Return Authorization Number at this time.

4. Return the unit, freight prepaid. Include in the shipping carton a reference to the Return Authorization Number and a brief description of the problem.

Correct installation, use, maintenance, and repair are essential for proper performance of this product. The purchaser should carefully read the equipment manual. The purchaser will be billed for labor and shipping charges on any unit determined by HAL to be in working order when received for repair.

This warranty does not apply to any defect which HAL Communications Corp. determines is due to any of the following:

1. Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts;

2. Misuse, abuse, neglect, improper installation, or improper operation (including operation without a proper ground connection);

3. Accidental or intentional damage.

All implied warranties are limited in duration to a period of one year from the date of purchase by the original retail purchaser. HAL Communications Corp. disclaims any liability for incidental or consequential damages arising out of the use of, or inability to use, this product. This warranty gives you specific legal rights, but there may be additional rights.